KLINCKENBERG
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# Capacity Building For the Adoption and Application of Thermal Standards for Buildings (Project 00013379)

## *Final Evaluation Report*

## Contents

# 1. Executive summary

## *1.1 Brief description of project*

The project was developed in 1999, to address the issue of high energy demand for heating and cooling in buildings in Lebanon, and the lack of implementation of energy demand reduction measures which are expected to bring significant benefits to residents and businesses, the country and the environment. The project document was signed on 4 October 2001, and project implementation commenced in February 2002, with a planned duration of 2 years. The end date, was postponed, to 30 Aug 05. On 1 Sep 05, most of the project activities are completed.

Energy cost is very significant for Lebanese residents, and national energy consumption is expected to rise by 3 to 6% pa for the coming 2 decades. Many cost-effective measures exist to curb building energy demand, and the project seeks to improve the thermal performance of building envelopes, thus reducing energy demand. The development and subsequent implementation of a Thermal Standard for buildings was selected as the key development problem to be addressed by this project. Stakeholders of the project are the nationally involved parties in construction sector regulation and in building design. This includes Government, private sector (via their professional body) and civil society parties.

The project expected to deliver four main outputs to achieve these results:

1. A complete “thermal building guideline” through participation, consolidation and consensus among stakeholders.
2. Policy makers’ knowledge of economic, environmental and social impacts that would result from the adoption of Thermal standards.
3. Developers' willingness to incorporate energy efficiency building measures as a result of the introduction of economic incentive through specific financing mechanisms.
4. A competent verification and certification mechanism and issuing of building certificates that links the building specifications with its thermal performance through use of acceptable scientific means (certified computer simulations).

Regional cooperation was not the subject of a specific output, but was included in the project management activities.

## *1.2 Context and purpose of the evaluation*

The final evaluation is intended to assess the relevance, performance and success of the project. It looks at early signs of potential impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. It should also identify and document lessons learned, make recommendations that might improve the design and implementation of other UNDP/GEF projects, and forward vision recommendations related to the sustainability of project outputs.

Key issues in this evaluation include the relevance and quality of the technical outputs; stakeholder involvement in the development and introduction of the Thermal standard; process characteristics of the project; the sustainability of the project outcomes. For this evaluation, indicators have been developed for the issues relevant to UNDP/GEF Final project evaluation. An indicator targets an important, measurable aspect of an evaluation issue, to make a complex, qualitative issue measurable and (semi-) quantifiable. Ratings are based on these indicators, complemented with the contextual information and information of a strictly qualitative nature.

The evaluation included a desk review of project documentation; interviews with project officers and major stakeholders; additional desk review of technical outputs; and the analysis of the collected information, and assessment of the projects relevance, performance, success and potential impact. The evaluation took place from in August and September 2005, including a mission to Beirut.

## *1.3 Main findings, conclusions, recommendations and lessons learned*

### 1.3.1 Main findings & conclusions

Overall, the results of the project are good, given the starting point, the context and the size of the project. This evaluation takes into account that the original purpose of the project was to build national capacities for the adoption and application of thermal standards for buildings, and this has been achieved beyond the required performance level. It can reasonably be assumed that the developed and adopted Thermal standard will lead to significantly reduced building energy consumption, and reduced national greenhouse gas emissions. The reduced building energy consumption will also lead to a lower national energy demand, thus a reduced (or lower increase) in national energy imports.

The *project formulation* was appropriate: The project targeted an urgent national need, recognized by important governmental and civil society stakeholders, and the project design was balanced. Some issues were not sufficiently assessed during project design, but planned for the first stage of project implementation. This resulted in a significant reshaping of the project in an early stage. This redesigning of the project was efficiently managed and included an extensive stakeholder consultation. This stakeholder involvement resulted in a project with very strong national ties and support.

*Project implementation* was excellent. The project had to deal with several challenges, stemming from underestimated facts in the project design, unexpected difficulties with consultants, unexpected temporary inactivity of a complementary project, and to some extent national political situations. Project management adapted the project very adequately in response to these challenges, and has kept the project continuously on track towards its objectives. It has spent a lot of time and effort on managing the stakeholder relations, and with success. The Order of Engineers and Architects, the national association for engineers involved in building design, has committed itself in various ways to the cause of energy efficiency improvement, supported the project extensively and is disseminating and endorsing project results amongst its members. Stakeholders repeatedly expressed their appreciation of their role in the project, and the way that this was managed.

The project has kept good track of changes in the project environment, outputs and other relevant issues, and activities, budgets and timing have been adapted accordingly. This has been instrumental to the smooth continuation of the project, despite several difficulties. Spending on the project is proportional, has been cost-effective, and the delivered outputs are more than adequate in relation to the available budget. The UNDP country office has provided good oversight of the project and support for the project manager. The project manager has shown an exceptional performance and commitment in the implementation of the project.

The *project results* are good. The Thermal standard has been developed, and has been accepted by the main stakeholders for voluntary adoption now, and mandatory adoption in 2010. Mandatory implementation, however, is not yet arranged and a legal procedure should be initiated for this step. It should be noted that the technical analysis, supporting the standard, was conducted with limited resources and is of a (too) limited scope, according to international practice. The final reports showed serious flaws; following this evaluation, these have been corrected. The consequences of those corrections, and of the limited scope of the analyses, should be discussed for the mandatory adoption of the standard.

The various stakeholders have been properly sensitized to the concept of a thermal standard, and endorsement has been solicited from all target groups, and a high level of support has been received. Professional capacities for the adoption of the standard have been built, and this is further supported by various tools. The sustainability of the outcomes is very good. The project has established various arrangements with stakeholders to sustain the outcomes, and during the project several stakeholders have initiated activities that support the impact of the Thermal standard in Lebanon.

### 1.3.2 Recommendations

The recommendations cover suggested actions to correct issues in the output or outcome of the project; suggested actions to reinforce the outcome of the project in Lebanon; and suggestions for future work, furthering the cause of energy conservation in buildings.

The main issue for corrective action is the quality of the technical outputs for the Thermal standard. Several of the technical outputs (climate zoning report, energy and economic analysis) were not fit for publication in their current state (at the time of the evaluation), and it is strongly recommended to review and upgrade these documents[1]. Regarding project outputs, it is also suggested to clarify the (formal) status of two design guides, the 'Technical guide for the application of the thermal standard for buildings in Lebanon' and of the (currently) draft report 'Climate and Comfort; passive design strategies for Lebanon', and their role in the Thermal standard implementation process. Further recommended activities to mitigate some implementation issues is to agree on a plan, with DG Urban Planning, on the integration of thermal standard compliance checking with the building quality verification & enforcement structure that is currently being developed, and to formalize a monitoring structure for the voluntary (and later mandatory) adoption of the Thermal standard.

Before mandatory adoption of the Thermal standard, it is recommended to upgrade this standard by conducting more comprehensive modeling, with more data and more building typologies, to include all major aspects of building envelope thermal performance, to update the price characteristics and to include the first experiences with the adoption of the Thermal standard in buildings. In parallel, the climate zoning should be reviewed in light of additional climatic data and stakeholder feedback. Such analysis could likely be conducted by national universities and professional bodies, with some high-level international advice on modeling issues and the general approach of such activity.

Several options have been identified to reinforce the success of the Thermal standard development. Adding an item about the (voluntary) application of the Thermal standard at the formal building permit application form would be a simple, but effective way of raising the profile of the standard. Demonstration projects, of buildings where the standard was applied, could be very useful in the continued dissemination and sensitization of the construction sector to thermal performance issues, especially if these projects also include monitoring of the (energy) benefits of the Thermal standard. Information about the trade-off between higher first cost and lower running cost (developed by this project) could be included in public awareness raising campaigns (of the Lebanese Centre for Energy Conservation Project).

Recommendations for future work in the energy performance of buildings are to target heating, cooling and ventilation equipment, appliances and lighting. Especially air conditioning equipment, water heaters and lighting are recommended priorities. Air conditioning energy efficiency can deliver large energy savings, and is especially useful in reducing peak power demand. Water heating with solar boilers would present a sustainable solution for hot water demands, without a rise in energy demand. Lighting energy efficiency (especially office lighting) reduces energy demand directly, and via reducing cooling loads. In the future, the Thermal standard could be elaborated into an energy performance standard for buildings (taking into account equipment efficiency), and/or extended to also cover major retrofitting and new additions to buildings. A program to upgrade local building material manufacturing and to certify local products according to international standards would be instrumental in transforming the construction industry.

[1] In response to the draft evaluation report, corrective action has been initiated on some of the technical outputs. The corrections undertaken of the climate zoning report and the energy analysis and economic feasibility study, when completed, will lead to sound technical outputs, although of a limited scope.

### 1.3.3 Lessons learned

The project, including its design, implementation and results, shows many insightful lessons.

A first lesson is in the excellent, intensive involvement of stakeholders throughout the project. Elements of this involvement are a project steering group included all stakeholder groups, and was involved in all decision during the project; the involvement of key national stakeholders in the development of project outputs; and supporting that stakeholders develop their own links and usages of the project outputs. These elements, and the open and informative management and communication style of the project management, explain the success of the stakeholder involvement.

Secondly, the project was led by two project champions. The Order of Engineers and Architects, a professional body, was an institutional stakeholder, and the project manager has provided personal leadership well beyond her professional duties. Establishing such project champions is crucial for the success of a project.

The third lesson is that reality checking and technical backstopping on all project outputs is essential. In this project, universities and professional bodies have been very active in providing expert feedback on the reality of project outputs, which has greatly contributed to the quality of the project outputs. The lesson is also that for specific issues, independent (international) advice would be beneficial to improve the overall approach of technical work.

A last lesson is that an in-depth assessment of national regulatory infrastructure is needed, for the development of new regulatory policies. These policies rely on other regulatory and institutional aspects, and essential issues are easily overlooked during project design. A detailed analysis could reduce this risk, and allow a better inclusion of wider ranging regulatory and institutional aspects.

### 1.3.4 Ratings of project components

Rated elements in the project formulation, implementation and results are listed here.

The overall appreciation of the project formulation is good. Rated elements are:

- Conceptualization / Design: *satisfactory*
- Stakeholder participation: *highly satisfactory*

The overall appreciation of the project implementation is excellent. Rated elements are:

- Implementation Approach: *highly satisfactory*
- Monitoring and Evaluation: *satisfactory*
- Stakeholder participation: *highly satisfactory*

The overall appreciation of the project results is good (satisfactory). Rated elements are:

- Reduce greenhouse gas emissions (Development objective 1): *marginally satisfactory*
- Establish thermal energy standards for buildings and prepare grounds for future adoption of the standard as an energy code for buildings (Development objective 2): *satisfactory*
- Initiation of a transformation in the construction industry in Lebanon (Development objective 3): *highly satisfactory*
- Review of the 'Thermal Building Guidelines' prepared by LIBNOR and conduct an environmental, Economic and Social Assessment of these guidelines (Immediate objective 1): *marginally satisfactory*
- Production of completed and agreed-upon thermal building standard document (Immediate objective 2): *satisfactory*
- Dissemination and sensitization of policy makers, professionals and the general public (Immediate objective 3): *satisfactory*
- Capacity building of resources and skilled manpower in thermal building standard adoption methods and designs and in certification and verification process for compliance (Immediate objective 4): *satisfactory*

# 2. Introduction

## *2.1 Purpose of the evaluation*

The final evaluation is intended to assess the relevance, performance and success of the project. It will look at early signs of potential impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The final evaluation is also supposed to identify and document lessons learned and to make recommendations that might improve the design and implementation of other UNDP/GEF projects. Furthermore, the final evaluation is to make forward vision recommendations related to the sustainability of project outputs.

The deliverables of the evaluation process are:

- List of evaluation indicators
- Questionnaires to be used during interviews
- Interviews reports (summary versions)
- Draft final report
- Final report

## *2.2 Key issues addressed*

Key issues in this evaluation include:

- The relevance and quality of the technical outputs (Climate zoning, energy and economic analysis, thermal standard, technical guide for the thermal standard, software tool for the thermal standard);
- The stakeholder involvement in the development and introduction of the Thermal standard, and the national implementation process;
- Process characteristics of the project, steps taken during the project and distinctive characteristics of the project implementation;
- The sustainability of the project outcomes, and further action recommended to improve the impact and sustainability of these outcomes.

## *2.3 Methodology of the evaluation*

This evaluation aims at assessing the projects relevance, performance and success, early signs of impact and sustainability of results, identifying lessons learned, and making recommendations for the sustainability of project outputs and for future projects. For this, evaluation indicators have been developed, based on the evaluation issues relevant for UNDP/GEF Final project evaluation (annex 3, evaluation indicators).

An indicator targets an important, measurable aspect of an evaluation issue, with the aim to make a complex, principally qualitative issue measurable and (semi-) quantifiable. During the evaluation, fact-finding focuses on collecting data regarding these indicators (next to general qualitative and contextual information about the project), and during the analysis the projects results are valued against indicators (ranging from below to above what has been / might have been expected or was implied in the project design). Given the extent of the project and the complexity of the subject, not all aspects (of all issues) can be targeted during this evaluation.

Evaluation issues have been rated according to the assessment of the project on the indicators, complemented with the contextual information and information of a strictly qualitative nature. The rating is reported and justified in the *Findings and Conclusions* section. The Evaluation outline (annex 2, Evaluation itinerary) provides a full overview of the project methodology.

### *2.4 Structure of the evaluation*

The evaluation included the following steps:

- The desk review of (all kinds of) project documentation, including the project document, progress reports, and outputs. This review has served to (a) generate an overview of the project, its context, proceedings, outputs and outcome; (b) develop a list of evaluation indicators for the assessment of the project; and (c) to collect data regarding the evaluation issues and indicators. Further documentation (interim technical reports, workshop reports, financial statements) have been reviewed to answer specific issues. The desk review has taken place in the initial stage of the evaluation. A list of reviewed documents is included in annex 4 (List of documents reviewed).
- Interviews with project officers and (representatives of) major stakeholders involved in the project. The interview schedule is included in annex 5 (List of persons interviewed). These interviews have served to (a) complete the overview of the project, in its context, and the relevance and (future) impact of the projects outcomes according to the involved organizations and stakeholders; (b) complete the fact finding regarding the evaluation issues and indicators; and (c) assist in the assessment of the project by asking the involved organizations about their impression of the projects results on specific issues (indicators), where relevant. A questionnaire, developed during the desk review phase, was used for these interviews (semi-structured interviews). Questions are included in the summary interview reports (annex 6).
- Additional desk review of (interim and final) project outputs and documents has taken place at a later stage to create a better overview of the issues that have led the project team to change their international consultant and of the technical issues that emerged during the review of the project. Detailed technical comments regarding the technical outputs have been included in annex 7 (Detailed technical comments regarding project outputs).
- The analysis of the collected information, and assessment of the projects relevance, performance, success and potential impact. Collected data have been analyzed and structured according to the evaluation indicators. Where target values for evaluation indicators exist (in the project proposal or in the progress reports[2]), the observed results of the project have been compared to these target values. Where these target values did not exist, a status quo description has been given and an assessment of the projects results based on a review of the project documentation (and the implied assumptions in it), reference information from similar developments (of thermal standards) in other environments, stakeholders opinions and the evaluators judgment. Ratings have been assigned based on this information. Together with the overview and contextual information, this formed the basis for this final evaluation report.

The evaluation took place from 15th August to 31st October 2005, including a mission to Beirut from 29th August to 2nd September 2005. At this time, the project was near finalization, although some national outreach activities were still to be completed. Due to the political situation in Lebanon in early 2005, these activities had to be postponed. It was decided to execute the final evaluation at this time, to be able to contribute to a regional assessment of similar projects. Since almost all project activities had been concluded, this presented no significant difficulties for the evaluation process.

A draft final evaluation report has, via the UNDP Lebanon country office, been circulated with the project team and the main stakeholders of the project. Comments and additions have been included in this final version of the report.

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[2] Major changes in the project design have been initiated via progress meetings. The reports of these meetings complement the project document in these aspects.

# 3. The project and its development context

## *3.1 Project start and duration*

The project was developed in 1999, to address the issue of high energy demand for heating and cooling in buildings in Lebanon, and the lack of implementation of energy demand reduction measures which are expected to bring significant benefits to residents and businesses, the country and the environment. The project is a part of a regional project (together with a similar project in Palestine), and was designed to be implemented in parallel to another UNDP/GEF-project (LEB/99/G31, 'Cross Sectoral Energy Efficiency and Removal of Barriers to ESCO operation'). The latter project couldn't be implemented before 2002, and it was decided to postpone the implementation of this project until 2002 as well.

The project document was signed on 4 October 2001, and project implementation commenced in February 2002, with a planned duration of 2 years. The end date of February 2004 (planned at project inception), was postponed four times, for the following reasons:

- A four-month extension (Feb 04 – Jun 04) was agreed, to allow for additional work on the thermal standard, in response to the evaluation of a pre-existing guide for thermal comfort;
- In March 2004, a three-month extension (Jun 04 – Oct 04) was agreed by the three-partite meeting, to allow for correction of inappropriate results delivered by an international consultant;
- In July 2004, a further three-month extension (Oct 04 – Jan 05) is reported in the Annual Project Report 2004, due to further difficulties in the delivery of results of the international consultants;
- Later in 2004, an additional four-month extension (Jan 05 – May 05) was agreed to allow for the additionally needed time to correct technical errors in the work of the (first) international consultants;
- In early 2005, the end date of the project was extended to 30 Aug 05 (reported in Annual Project Report 2005), due to the political situation in Lebanon in spring 2005 preventing the implementation of capacity building activities.

On 1 Sep 05, most of the project activities are completed. Some outreach activities, however, had to be postponed to Oct 05, again due to the political situation in Beirut. A final project report has yet to be prepared[3]. Based on the recommendations in the draft final evaluation report, UNDP is currently extending the project duration to Dec 05, to allow for some corrections and additions to the project outputs.

## *3.2 Problems that the project seeks to address*

The project addresses the energy use for heating and cooling in buildings. Energy cost is very significant for Lebanese residents, and national energy consumption is expected to rise by 3 to 6% pa for the coming 2 decades. Many cost-effective measures exist to curb building energy demand, and the project seeks to improve the thermal performance of building envelopes, thus reducing energy demand. The development and subsequent implementation of a Thermal Standard for buildings was selected as the key development problem to be addressed by this project.

[3] The performance on some outcome indicators had to be estimated, lacking a full overview of the project progress in a final report. The reader is advised to also refer to this final report, and cross-check outcomes.

Baseline activities on thermal performance of buildings were ongoing in Lebanon before the development of this project, but many barriers existed for this to become an effective national strategy:

Institutional barriers

- Uncompleted thermal guidelines, hindering their transformation into standards.
- Lack of a coordinating mechanism between the body which develops the codes, the body which adopts the codes, and body which applies the codes, which would hinder adopting standards and putting them into effect.
- Absence of adequate verification, supervision and certification mechanism, so that developers may not evade compliance.

Economic barriers

- Absence of economic feasibility studies, which would substantiate the investment in energy efficient building measures by establishing payback time.
- Absence of economic incentives, which would instigate developers (who are not necessarily the end-users of the building unit and payers of the energy bill) to incorporate energy efficient measures despite an increase in construction cost.

Information and capacity barriers

- Policy makers' unfamiliarity with environmental, economic and social benefits.
- Architects, engineers, and contractors unfamiliarity with methods of design and execution of energy efficient buildings.
- Consumer unawareness of favorable environmental, comfort and life-cycle economic benefits.

The project design included technical, institutional and capacity building components, as well as coordination with another UNDP/GEF-project ('Lebanese Centre for Energy Conservation Project), to overcome these barriers.

### *3.3 Immediate and development objectives of the project*

The development objective of the project was the *Reduction of $CO_2$-emissions into the environment*, by means of the *Establishment and Adoption of energy codes for buildings*.

Goals of the project were to achieve:

- Building local capacity in the field of energy-saving modalities in buildings;
- Wide public adoption of cost-effective energy-saving modalities in buildings;
- Transformation of construction industry;
- Regional cooperation is established.

These goals should have objectively verifiable outcomes in the country:

(development objectives)

- An energy standard for buildings will be established in Lebanon and endorsed by the Lebanese Government by the year 2001;
- Annual energy saving of 0.02 MTOE for Lebanon (2001-2020).

(immediate objectives)

- Increased number of energy-efficient buildings during voluntary application of the standard (2002-2010).

- Increased demand on energy-efficient building material and designs
- Improved energy performance in residential buildings
- Increased public awareness of energy-saving modalities
- Increased knowledge and expertise in energy-efficient modalities by civil engineers, architects and contractors

### *3.4 Main stakeholders*

The stakeholders of the project are primarily the nationally involved parties in construction sector regulations and in building design. Government stakeholders are:

- The Lebanese Directorate General of Urban Planning (under the Ministry of Public Works) is the body responsible for the advancement of building laws;
- Municipalities at the decentralized level (under the Ministry of Municipal & Town Affairs) are another body that can play a role in the compliance process to the building law;
- Ministry of Energy and Water, whose participation may be needed to achieve better bill collection and tariffs incentives, which indirectly contribute to the successful implementation of the thermal buildings standard (the thermal standard will reflect a lower energy bill for heating and cooling purposes).

Furthermore, the following parties have a key role to play in the advancement of thermal building codes:

- Lebanese Norms Institute (LIBNOR), responsible for setting national norms and standards. These standards are voluntary in principle unless endorsed by the government.
- Council for Development and Reconstruction (CDR) constituted in 1991 after the end of the war. It is a governmental organization for planning and resource mobilization.
- The Order of Engineers and Architects founded in 1952 currently comprising around 20,000 professional members from the various fields of Engineering, and the field of architecture. Membership in the Order is a prerequisite for professional practice in the country.
- Municipalities may play a very significant role in the verification process during construction of new buildings or through implementation of new rules for old existing buildings. The Beirut Municipality, in particular, has a larger role to play, since it issues building permits independently within Beirut for limited residential type buildings and has a large professional staff. Other Municipalities are represented through the Ministry of Municipal and Town Affairs.
- The Syndicate of Contractors in Lebanon which is not involved in policy settings.
- Association Libanaise pour la Maitrise de l'Energie (ALME) is a national scientific NGO. It comprises around 50 professionals specialized in the various fields of engineering, architecture and economics.
- Local Universities may play an important role in the training of graduating professionals and emphasizing the energy code of practice for efficient buildings. American University of Beirut (AUB), Lebanese University (LU) and the Ecole Superieure des Ingenieurs a Beyrouth (ESIB) are all involved in studies and research on energy conservation, energy efficiency and energy management in buildings.

### *3.5 Results expected*

Upon completion of the project, the Government of Lebanon will have greatly increased public awareness of cost-effective energy-efficient building materials, methods and designs, as well as

benefits of energy efficient measures in buildings. Overall, it will possess improved institutional, human and resource capacities in the field of energy efficiency and standards in buildings and transformation of the construction industry. The expected end of project situation can be summarized as follows:

1. Following barrier removal, an adequate policy and market environment will emerge, as well as the needed capacity to formulate and adopt energy codes for buildings.
2. Information dissemination tools and increased public awareness will have been developed about cost-effective energy- efficient building materials, methods and designs, as well as benefits of energy efficient measures in buildings.
3. Skilled human and resource capacity will have been built in the field of energy efficiency and standards in buildings and transformation of the construction industry.
4. Sustainable public and private point responsibility will have been established to promote and adopt energy standard in buildings and support energy conservation practices at the formal and informal level.
5. An institutional mechanism will be recommended on verification and certification of building thermal standard compliance by developers.
6. Market forces will be activated to increase demand on energy-efficient building materials and passive designs and initiate a change in the construction industry.
7. Regional cooperation and coordination in the field of energy efficiency in buildings will have been established.

The project expected to deliver four main outputs to achieve these results:

5. A complete “thermal building guideline” through participation, consolidation and consensus among stakeholders. Achievement of this output was expected to remove barriers 1 and 2.
6. Policy makers’ knowledge of economic, environmental and social impacts that would result from the adoption of Thermal standards. Achievement of this output was expected to remove barrier 6.
7. Developers' willingness to incorporate energy efficiency building measures as a result of the introduction of economic incentive through specific financing mechanisms. Achievement of this output was expected to remove barriers 4 and 5.
8. A competent verification and certification mechanism and issuing of building certificates that links the building specifications with its thermal performance through use of acceptable scientific means (certified computer simulations). Achievement of this output was expected to remove barrier 3.

Regional cooperation was not the subject of a specific output, but was included in the project management activities.

# 4. Findings and Conclusions

## *4.1 Project Formulation*

In general, the project formulation was appropriate for the national context and development issues. The project targeted an urgent national need, recognized by important governmental and civil society stakeholders. The project design was balanced, assigning most attention to the most demanding issues. Some critical issues were not sufficiently assessed during project design; this was planned for the first stage of project implementation. This was a risk, and the assessment indicated that some significant changes to the project design would be needed.

The redesigning of the project was efficiently managed and included an extensive stakeholder consultation. The stakeholder involvement, which was already included in the original project design, was further extended in this updated project design, which resulted in a project with very strong national ties and support. Unfortunately, formal project documents where not revised at this revision stage (although all changes are properly reported in progress and tripartite meeting reports), thus making one of the project management tools less useful.

The overall appreciation of the project formulation is good. Rated elements are:

- Conceptualization / Design: Satisfactory
- Stakeholder participation: Highly satisfactory

### 4.1.1 Conceptualization/Design (R)

The project design targets heat gains and losses via the building envelope, one of the major components in building energy performance. Targeting building envelope thermal performance, via a Thermal standard, is a logical and necessary step, and can bring significant benefits to a country. It has also been a common first step in the development of national building energy policies, in many countries. Prior to this project, awareness of building energy performance was minimal with the public and politicians, and low even among professionals.

The need to target building energy consumption was widely and is recognized, and supported, in Lebanon. All stakeholders identified the need to reduce (building related) energy cost, and minimize national energy consumption and $CO_2$-emissions. Energy imports are a major cost to the national budget, and reducing (or dampening an increase of) these imports, has many benefits. Energy cost has been a daily concern for many Lebanese for years, but the relationship of a higher first cost (due to investments in energy conservation) versus lower running cost was not recognized, nor acted on. This project was to provide the tools to regulate the thermal performance of the building envelope, and to facilitate professionals in doing this properly.

The project design was rooted in an assessment of the energy situation in Lebanon (for the first national UNFCCC communication). The design justly emphasized that the implementation of a regulations for the thermal performance of buildings is a more demanding step than the development of a standard, and, consequently, more attention was given to the implementation than to the development steps. The project design stressed the roles of stakeholders, and the need to include stakeholder representatives in all stages of the project. This has greatly benefited the project.

The project design included regional coordination with other countries in the region, involved in similar projects. The coordination structure was appropriate for this project. No specific action was planned to analyze experiences in countries with longer histories in regulating energy performance of buildings, which might have been a useful addition to the project. This analysis, however, was made part of the other, technical development, activities in the project.

The project design was based on the assumption that the previously developed, but never introduced, Thermal Comfort Guidelines, would be a sufficient technical basis for a thermal standard. An assessment of this assumption was planned at the start of the project. If these

Guidelines would not be sufficient (and these weren't), significant changes in the project would be needed. It would have been preferable to perform such assessment during project design. Similarly, the project design didn't analyze the national verification and enforcement capacity for building quality aspects, which is important for any mandatory standard.

A logical framework and performance indicators were developed during project design. The project consisted of four well-balanced components, and sufficient indicators to track the impact of the project on the building sector in Lebanon. Given that the project was significantly revised following the assessment of the Thermal Comfort Guidelines, some of the indicators were no longer relevant for this project design. During the project, progress was very regularly tracked and discussed, and corrective actions were taken as needed. These were discussed in yearly tri-partite meetings (government / UNDP / project management), and also discussed in yearly progress reports.

Unfortunately, the project didn't seek to update the project document or logical framework after learning that a significant revision of the project was needed. Necessary changes were proposed, following the assessment of the Thermal Comfort Guidelines, and discussed with all relevant parties (including stakeholders), which is commendable. The changes made are relevant to the goal of the project, and required to achieve this goal. However, the budget that could be made available from within the project was quite small for a full technical analysis of building energy performance, and the approach chosen (to have a detailed technical analysis, but with a rather limited resource input) did not do justice to the goal of this additional goal. In retrospect, the choice of a less detailed analysis, built more on national engineering practice, might have been a better option given the available budget, or a reconsideration / renegotiation of the scope and budget of the project.

There is no indication that a more formal approach to make these changes would have resulted in a different outcome. The choice not to prepare an updated logical framework (or project document), however, implied that the project has been missing a formal, integrated framework against which to track progress, as well as an integrated tool to communicate the goals of the project with stakeholders. This is unfortunate, and could easily have led to a loss of focus in the project. The fact that it didn't (instead, the project has shown a good focus on the goals to be achieved and inclusion of stakeholders in all stages of the project), should be attributed to the quality of the project management (including country office oversight) and not to the wisdom of this choice.

Evaluation indicators for this item:

1. Project design targets root causes of building energy consumption: yes
2. Project design (summarised in LogFrame) is appropriate and suitable for the national context: yes, with high level of attention for stakeholder roles
3. Project design includes sufficient indicators to track progress and measure outputs: yes, but not revised after revising the project design

Rating: satisfactory

### 4.1.2 Country-ownership/Drive

The project has strong roots in the country. The project is a perfect match with the national goals to reduce national energy consumption and cost, as well as to reduce household energy bills. From the beginning, the project has received strong support from the national civil society (particularly the professional associations), and was also built on their willingness to contribute to the cause of improving the thermal performance of buildings.

The project was executed by the Directorate-General for Urban Planning, which is the primary regulatory body for the construction sector. This directorate, although having no previous involvement with energy efficiency, has supported the project with in-kind contributions and the use of its name and network for the project. According to other stakeholders, this support by the

DG Urban Planning has been critical for the success of the project and the credibility of the outcomes for the construction sector.

The project results have been taken up by three national organizations: the Lebanese standards institute (a governmental body) has initiated a process to formalize the Thermal standard developed in the project; the Order of Engineers and Architects (a non-governmental organization, but with national regulatory tasks) actively communicates the results of this project, and the wider message of building energy efficiency, to its members; and the Lebanese Government (via the DG Urban Planning) has created a regulatory incentive to promote the adoption of the Thermal standard, and is planning for mandatory adoption of the standard in 2010.

Evaluation indicators for this item:

4. Project concept originates from within and is supported by national institutions: yes

5. Project concept targets pressing national environmental and development needs: yes

### 4.1.3 Stakeholder participation (R)

Stakeholder involvement in the project has been extensive, and very successful. Government and civil society stakeholders have been involved in project management (via a steering group, as well as via bilateral contacts), have significantly contributed to the development of the project outputs and have provided the project with many resources (personnel, expertise as well as 'network').

Information dissemination, primarily to the professionals that would need to work with the project outputs, has been conducted in close cooperation and with full support of national stakeholders. The relevant parties (professional bodies and universities) have been involved in the outreach to professionals, and have arranged to continue doing so after completion of the project. Specific tools have been designed to support this (website, CD-ROM). It is estimated that approx 2000 active professionals have been exposed to intensive communication (workshop, training session etc), and more have been exposed via less-intensive means.

Stakeholders have been frequently consulted during the project, to build and maintain contacts with the relevant target groups. They engaged in the design and fine-tuning of project activities, and have provided reality checking and technical backstopping on project outputs. The project management has maintained an open dialogue with stakeholders throughout the project, and this has significantly contributed to the success of the project.

Evaluation indicators for this item:

6. Stakeholders have been actively and passively informed about the project and its results: yes, on all aspects

7. Key stakeholders have been consulted about core project decisions and have provided significant input into the project: yes, to a very high degree.

Rating: Highly satisfactory

### 4.1.4 Replication approach

During project implementation, experiences and lessons learned have been exchanged with similar ongoing projects in the region (Palestine, Tunisia, Egypt), and with an already completed thermal insulation code (Jordan). This has been beneficial to this project, and probably to the other projects as well.

No formal exchange of experiences is foreseen after this project, although that would certainly be recommended. This project includes some important lessons and can share some very definite good and bad experiences, which are likely to be of great interest to other countries, many of which are developing building energy efficiency regulation, or would benefit from such activity.

Some of the experiences of this project are indicated in the Lessons Learned section of this report. This, however, does little justice to the richness of the experiences of the project.

Evaluation indicators for this item:

8. Project has communicated lessons learned and sought cooperation with new or ongoing projects of similar concept: yes, during project implementation (not before or after)

### 4.1.5 UNDP comparative advantage

The linkage of this project with the UNDP/GEF-project 'Lebanese Centre for Energy Conservation Project (LCECP) was a well-designed element, which should have been beneficial to this project in its market assessments, financial incentives and outreach, in complementing the output of this project with building equipment (heating, air conditioning) policies and to sustain the results of the project. Additionally, the UNDP could link this project to similar, ongoing projects in Egypt, Tunisia and Palestine[4], which allowed for exchange of best practices and experiences.

Unfortunately, the LCECP-project suffered from serious delays, and was re-initiated in January 2005, close to the end of this project. Linkages with this project in market assessments, financial incentives and outreach during project implementation where therefore very limited. In fact, this missing linkage (which also included a planned input of survey-results from the LCECP-project into this project) caused some difficulties, as alternatives needed to be developed for these inputs. From 2005 on, linkages have been restored, and coordination with the LCECP-project has been initiated (however LCECP cannot commence implementation until these activities are formally introduced in the LCECP project Document). This appears to be a valuable addition to the project, and an important factor in sustaining the impact of this project on the construction market in Lebanon.

Evaluation indicators for this item:

9. Project is linked with other projects or programmes in the sector via well-developed management arrangements: yes, some integration with other UNDP/GEF-project

[4] Formally, the Lebanese and Palestinian projects are part of one UNDP/GEF-project, although these are implemented separately. This evaluation focuses on the Lebanese project only.

### *4.2 Project Implementation*

Overall, project implementation was excellent. The project had to deal with several challenges, stemming from underestimated facts in the project design, unexpected difficulties with consultants, unexpected temporary inactivity of a complementary project, and to some extent and national political situations. Project management adapted the project very adequately in response to these challenges, and has kept the project continuously on track towards its objectives. These objectives were achieved, after some delays, and with some changed project activities.

Overall project outputs exceed the originally expected ones, and the project has kept within the budget. Stakeholder involvement in the project was excellent, and exceeds the (already significant) planned involvement. The project manager has spent a lot of time and effort on managing the stakeholder relations, and with success. Especially the role of the Order of Engineers and Architects, the national association for engineers involved in building design, should be noted. The Order has provided extensive support to the project, has committed itself in various ways to the cause of energy efficiency improvement, and is disseminating and endorsing project results amongst its members.

The project has kept good track of changes in the project environment, outputs and other relevant issues, and activities, budgets and timing have been adapted accordingly. This has been instrumental to the smooth continuation of the project, despite several difficulties. Budget management has been adequate and timely responding to changing needs. The weekly project management – UNDP briefings served as a first stage to discuss and agree changes, and yearly tripartite meetings confirmed these in a second stage. Progress was recorded via (brief) quarterly summaries, PIRs and (extensive) yearly progress reports.

The financial side of the project has been adequately managed. Spending on the project is proportional, and has been cost-effective. The delivered outputs are more than adequate in relation to the available budget, and the budget was spent on incremental costs.

Stakeholders repeatedly expressed their appreciation of the role they could have in the project, and the way that this was managed. The UNDP country office has provided good oversight of the project and support for the project manager, by weekly briefings and other means. Special recognition should be given to the project manager, Matilda El-Khoury, who has shown an exceptional performance and commitment in the implementation of the project, and the Order of Engineers and Architects, which supported the project well beyond the level that may be expected of a professional body. The work of these two 'project champions' has been instrumental to the successful implementation that was achieved.

The overall appreciation of the project implementation is excellent. Rated elements are:

- Implementation Approach: highly satisfactory
- Monitoring and Evaluation: satisfactory
- Stakeholder participation: highly satisfactory

#### 4.2.1 Implementation Approach (R)

Project implementation has been challenging, due to unforeseen technical difficulties and at times a national political context that hindered project implementation. Overall, these issues have been very well managed, and in all situations acceptable solutions have been implemented to overcome the difficulties. The project design was significantly revised during project implementation, and the duration of the project extended to allow time to mitigate the effects of difficulties.

A logical framework was developed during project design, but not used during project implementation. In fact, when revising the project (in response to changing conditions and monitoring of project progress), the logical framework was not updated, although the revision was

significant and an update would have been advisable. This seriously limited the usefulness of the framework for further monitoring or management purposes.

Nevertheless, the project management, in good cooperation with the UNDP country office, has applied good adaptive management, monitoring progress and the conditions in which the project operated, and soliciting and assessing stakeholder feedback. This was followed up by regular reviews of the project design, and adaptations of activities and budgets to reflect changes. Progress, including observed progress, stakeholder or project environment issues, was reported once a year in formal progress reports, discussed yearly in tripartite reviews and in between discussed with the UNDP country office. It should be noted that the country office has taken a very active and supportive role in this process, which very likely contributed to the continued focus of the project on realizing its goals, despite the (significant) difficulties encountered in implementation. In addition, the project management regularly consulted with stakeholders about interim outputs and upcoming issues, and recognized this feedback in their response.

The project was executed by the Directorate-General for Urban Planning (DGUP), part of the Ministry of Public Works. The project team was hosted at the DGUP offices, and a DGUP Focal Point officer has kept a close working relationship with the project management. A project steering committee, consisting of the relevant Government departments and civil society representatives, was established and has met regularly during project implementation. The operation of this steering committee is an example of good implementation, as was the involvement of civil sector and university stakeholders in the assessment and reality checking of project outputs (see section Lessons learned).

A project website was developed, to communicate the set-up and progress of the project to the wider community of public and private sector professionals. This website was originally hosted at the DGUP website, which suffered from regular interruptions / downtime. The Order of Engineers and Architects (OEA) was asked to take over this website, and the site has been on-air there since. As the outreach via the website is primarily intended for private sector professionals, for who the OEA-website already was an important source of information, this change has probably benefited the project by creating a better integration with regular information channels for the target group. The project has further developed a software tool (not foreseen in the original project design), to support the application of the Thermal standard by professionals. All outputs (including the software tool) are made available on CD-ROM, and will be downloadable from project section on the OEA-website after completion of the project.

In the original design, the project was expected to require limited technical capacities (in thermal standard development). It was expected that the technical quality of the Thermal Comfort Guidelines would be sufficient, and that a relatively easy translation of the guidelines into a standard would suffice. An assessment, early in the project, learned that this was not the case and additional technical capacities needed to be employed for the development of a climatic zoning and a thermal standard for Lebanon. It was decided to recruit the support of an international consultant for these two outputs, via the (then) standard selection procedure. Four proposals were received, three of which were considered technically sound. The cheapest of these was selected, without further consideration to the technical differences between proposals / consultants. The selection of this international consultant has attracted serious critique from the national stakeholders: it is claimed that the technical quality of the consultant has been given insufficient attention, and that too much technical quality was sacrificed for a lower bidding price. The UNDP country office has recognized this, and has since changed its selection procedure, with stricter technical requirements and a balancing of price versus quality in the selection of consultants.

During project implementation, the work of the selected international consultant was considered to be insufficient, even after an extensive exchange of opinions and various revisions of the draft

outputs[5]. The contract with this consultant was terminated, and a new consultant was selected to re-do parts of the work and complete the outputs. The resulting impact on the project was a significant delay, the need to assign a lot of management time on revision of the technical outputs, and some added cost (see section Financial Planning). National stakeholders and the project management were involved to provide significant reality checking and technical backstopping, which was a benefit to the project as such, but which should not have been necessary at this scale when working with a qualified international consultant. It should also be noted that, although the quality of the outputs has improved in the hands of the second consultant, there are still several outstanding technical issues.

Evaluation indicators for this item:

10. Logical Framework is used as a management tool during implementation: no
11. Implementation management is adaptive to changes in the project environment: yes, good adaptive management practices have been applied
12. ICT have been used to support project implementation and dissemination: yes, proportionally
13. The project established suitable operational relations between involved institutions and key stakeholders: yes, excellent relationships have been established and managed
14. The project employed the required technical capacities and made appropriate use of these: marginally. In the end, the project employed the required international technical capacities but this didn't prevent the technical work from showing more flaws than is justified by the difficult conditions in which the project operated. Even after replacement of the international consultant, significant revision of their outputs was / is needed (see also sections Results and Detailed technical comments regarding project outputs). National experts (involved via the project management and stakeholders) provided technical backstopping. This worked well, but it is not a preferred situation.

Rating: highly satisfactory

### 4.2.2 Monitoring and evaluation (R)

Project progress has been closely monitored, by the project management, and by the UNDP country office. There has been a frequent interaction between project management, the executing agency (DG Urban Planning) and the country office regarding implementation issues, changes in the project environment and the outputs, and required adaptations. The objectives of the project have been the focal point during these interactions, and adaptations to the project activities and budgets have been implemented whenever this was required to meet these objectives.

Several tools were applied to support the progress monitoring, including (brief) three-monthly summaries, PIRs and (extensive) yearly progress reports, summary presentations to the yearly tripartite meetings and presentations to and discussions with the (government / civil society) steering group. The required adaptations to the project design, following this monitoring, have been taken swiftly and correctly. This has provided for a more than adequate oversight (by UNDP, the executing agency and the stakeholders) of the progress of the project.

A formal comparison of the progress achieved against the (originally documented and revised) objectives and performance indicators was included in the yearly progress reports, and was mainly used to document progress (thus: primarily as process monitoring). In general, it would be advisable to regularly perform a full review of the (content of the) results achieved against the logical framework and the content objectives too, to bring all parties on the same level as well as

[5] Following this finding, a brief assessment of the interim technical outputs was conducted, to track the issues under discussion and to evaluate the project management's response to this issue. This assessment is included in the annex Detailed technical comments regarding project outputs.

to create a regular (e.g., yearly) moment of reflection on priorities and the assignment of capacities.

A final evaluation was included in the project design, but no mid-term evaluation. This is justified given the relatively small scope and duration of the project. It should be noted that the project management and the UNDP have extensively participated in the evaluation, and have shown to consider it as way to learn more about the project (which is probably the best way to look at an evaluation).

Evaluation indicators for this item:

15. The project has established progress monitoring and has undergone regular evaluations, which have led to required adaptations of the implementation: yes, via intensive management reports and meetings

Rating: satisfactory

### 4.2.3 Stakeholder participation (R)

The stakeholder participation in this project was extensive, and of high quality. Both government and civil society stakeholders were heavily involved in the project, to a larger extent than originally planned. The executing agency, the key government stakeholder itself, has been an active supporter of the project and has created favorable conditions for its development, and subsequent uptake by the market sector[6]. Other government stakeholders have been involved in the project steering group, and in workshops. Direct (monetary) government contribution to the project has been relatively small, compared to the GEF-contribution. The non-monetary contribution, however, has been significant. The project has been in contact with the Parliamentary Public Works Committee, to present the benefits of a Thermal standard directly to this decision making body. This outreach to public decision makers has taken up some management time, but the results are significant.

Civil sector stakeholders have been important parties in the project. The Lebanese Order of Engineers and Architects (OEA), the main professional organization for building design, has been actively involved from the onset of the project, and has taken up many responsibilities along the way. The OEA, which represents the 30,000 professional engineers and architects in Lebanon, has been instrumental in information dissemination, has provided technical input (including reality checking) for the development of project outputs, and has committed itself to the continued support of thermal performance improvement in buildings and the dissemination of project outputs after finalization of the project. National universities have actively contributed to the preparation of project outputs, by the development of a (non-planned) software tool that assists professional engineers in the adoption of thermal standard requirements, in integrating the thermal standard concept in their university work and in providing training to other stakeholders at workshops. The strong ties developed, and the active involvement of these stakeholders, have positively contributed to the project. Maintaining this involvement has been time-consuming, but it was a good investment. A downside to this process has not been identified.

Workshops and other outreach activities were tailored to the needs of the primary target group, professional engineers and architects, in timing and location, and often under the umbrella of one of their professional organizations. Private sector participation at these activities has been very good. Government sector experts were also invited to participate in these meetings. Their participation, however, was more limited. This was primarily attributed to the timing of the events,

[6] This includes the creation of a non-financial incentive in the recently adopted new building law, which includes a preferential treatment of building designs that apply the thermal standard (main technical output of the project)

which matched well with private sector requirements, but not with those of the public sector[7]. For future projects, it might be advisable to organize some events specifically tailored to the needs of the public sector.

In addition to the directly affected stakeholders, contacts have been established with the financial (mortgage banks) sector. This sector has shown interest in the concept of building energy efficiency, and has opened up to the option of supporting or demanding the energy performance of building. The banks did indicate, however, that they would rather consider thermal performance as part of a wider strategy, covering all building energy efficiency issues, than to apply separate strategies for each issue.

Contractors and other construction sector companies have marginally been involved in the outreach of the project. As the project primarily focused on the design phase of buildings (which is when thermal performance measures have to be implemented), and architects could provide a good overview of the possibilities of the construction sector, this was considered of lesser urgency. An outreach activity is planned, however, at the main construction sector trade fair (6 – 10 Sep 05), in collaboration with the UNDP/GEF-project Lebanese Centre for Energy Conservation Project.

Apart from being in contact and commenting on progress, the involved stakeholders have very actively contributed to the project, e.g. by organizing events around project outputs or linking the development of the thermal standard to regular (university) education activities. As one (Lebanese government) observer puts it: 'During project implementation, stakeholders realised that they would require more (and sometimes different) outcomes than originally planned, and set out to achieve these (which they did)'.

Evaluation indicators for this item:

16. The project properly involved national and local stakeholders in implementation and decision making: yes, at a very high level.

17. The project properly involved government and other relevant institutions in implementation and decision making: yes, at a very high level

18. The project disseminated the required information to all relevant stakeholders: yes

Rating: highly satisfactory

### 4.2.4 Financial Planning

The actual project cost by objectives, outputs and activities is as follows:

[7] In Lebanon, the public and the private sector have different working hours, and there is little opportunity to tailor the timing of a meeting to the needs of both parties.

| Key Activities | Budget Description | Sub-Total | Disbursed | | | | | Commitments | Remainder |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2001 | 2002 | 2003 | 2004 | 2005 | | |
| A1) Project Management | 71200 International Consultants | 10,000 | - | - | - | - | - | 10,000 | - |
| | 71400 Contractual Services-Ind. | 37,793<br>101,200 | -<br>- | 10,824<br>28,536 | 17,624<br>31,922 | 9,345<br>30,563 | -<br>10,179 | -<br>- | -<br>- |
| | 74500 Miscellaneous Expenses | 5,076 | 1,380 | 1,022 | 1,610 | 564 | - | 500 | - |
| A2) Appraisal & Assessment | 71300 Local Consultants | 27,960 | - | - | 20,960 | - | - | - | *7,000* |
| A3) Climatic Zoning, Energy Analysis and Thermal Standard | 71200 International Consultants | 142,642 | - | 8,688 | 50,316 | 31,188 | 52,450 | - | - |
| A4) Information Dissemination | 74200 Audio Visual Printing Prod. | 17,828 | - | 1,024 | - | - | 5,644 | 4,160 | *7,000* |
| | 72800 Information Technology Equip. | 15,034 | - | 11,013 | 4,021 | - | - | - | - |
| A5) Capacity Building, regional coordination & Sustainability | 71200 International Consultants | 73,024 | - | - | 14,000 | 13,524 | 45,500 | - | - |
| | 72100 Contractual Services-Comp. | 49,000 | - | - | - | 8,400 | 17,150 | 14,450 | *9,000* |
| | 71600 Travel | 5,120 | - | 1,381 | 3,255 | 484 | - | - | - |
| | 74500 Miscellaneous Expenses | 9,323 | - | 374 | 4,662 | 1,510 | 290 | 2,000 | *487* |
| | TOTAL | 494,000 | 1,380 | 62,862 | 148,370 | 95,578 | 131,213 | 31,410 | *23,487* |

N.B. 1: In-kind contributions are not included in the above budget breakdown.
N.B. 2: Key activity A2 to A5 relate to the immediate objectives D1 to D4, in that order, as specified in the project document.

Project costs per objective have not been specified in the project document, making a detailed comparison of actual versus planned spending per objective impossible.

In-kind contributions have been received from the Lebanese government, from the Order of Engineers and Architects and Libnor. No monetary representation of these contributions could be established. However, given the amount of inputs and outputs provided by these stakeholders, it is reasonable to assume that the total in-kind contribution amounts to at least the agreed sum of $ 91,000 (Lebanese government $ 20,000; Order of Engineers and Architects $ 71,000).

In general, it can be observed that:

- The project management budget (A1) increased by approx 50%, reflecting the increased duration of the project. Overall, project management cost represents 31% of the GEF-contribution (and 26% of the budget including in-kind contributions), which is relatively high[8]. It should be considered that a large share of the project management time was actually spent on technical reviews and revisions of project outputs, and on capacity building and outreach activities, and should probably be considered to belong to other budget categories;
- The budget for Immediate Objective 1 (Review the Thermal Comfort Guidelines and conduct an environmental, economic and social assessment of these guidelines) has been significantly smaller than planned. This reflects that the assessment of the Guideline concluded that this was not a suitable starting point for the rest of the project, and work on this Guideline was terminated;

[8] There is no strict standard for the project management share of a budget. As a rule of thumb, a share over 20% should be critically reviewed.

- The budget for Immediate Objective 2 (Produce the completed and agreed-upon Thermal Building Standard document) was significantly increased, and particularly the budget for international consultancy work. This reflects that much additional work was needed to prepare the Thermal standard, as well as the fact that, after a first consultant was assigned and partly paid, a second consultant needed to be contracted to revise and complete the work;
- The budget for Immediate Objective 3 (Dissemination and sensitization of policy makers, professionals and the general public on the Thermal Building Standards environmental, economic and social assessments through workshops and publications) was significantly reduced, particularly by scrapping an awareness raising budget earmarked for a televised public outreach campaign. It should be noted that much outreach and sensitization work has been undertaken by the project management (included in budget line A1) and the Order of Engineers and Architects (in-kind contribution);
- The budget for Immediate Objective 4 (Capacity building of professionals to energy efficient building design and execution) was increased, and additional outputs (software tool, climate and comfort design guide) have been added to the budget reflecting demands or suggestions from stakeholders.

Reflecting on the budget, it is noted that:

- The large redistribution of budget, to allow for additional work on preparation of the Thermal standard, has particularly affected the awareness raising activities. Given the status quo in the project, this was justified not only because the need to develop the Thermal standard was more urgent, but also because awareness raising would not be useful before the standard was being actually implemented (which is happening after the end of the project);
- The budget made available for the additional work to prepare a Thermal standard was fairly low for the task of performing a full, detailed energy and economic analysis of buildings. The choice to do a detailed analysis, but with a very limited scope, was probably not the best available option. Given the difficulties during implementation of this additional work, it is impossible to determine to what extent the flaws in the outputs of this analysis should be attributed to a too small task and budget allocation, and to what extent to underperformance of the involved consultants;
- Spending appears to have been cost-effective. Budgets are fair to low in relation to the delivered outputs, and consultants and main contractors have been selected via standard procurement procedures, with cost-competition. Overall, more outputs have been delivered than was originally agreed, within the original budget. A benchmark or a comparison with other, similar projects, however, could not be established, as this project is fairly new to the region and has been subject to several unique circumstances;
- One exception is the actual spending on an international consultancy. The contract with the first international consultant was terminated, because the deliverables of this consultant were judged as substandard, incoherent and unsatisfactory by the project. A settlement was agreed for this termination, and the consultant received a payment of 90% of his original budget. This settlement appears to be (too) generous in relation to the quality issues with the deliverables, and the significant additional work that needed to be performed (under a new contract) to upgrade these results;
- All cash spending (coming from the GEF-contribution), and most of the in-kind contribution, is in line with the GEF incremental cost criteria. The Ministry of Public Works in-kind contribution (into Reinforce of verification and certification offices through training of personnel) could not be separately identified. The Ministry has engaged in the reinforcement of a verification infrastructure for building quality issues, and thermal

performance is supposed to be part of that, but is unclear how much of that work was spent specifically on thermal standard issues.

- Disbursement on the project was delayed, reflecting delays in the project implementation. In 2005, some budget items are still committed, but not disbursed, and some items are not yet committed. This is in line with the finding that actual project activities are continuing after 31 Aug 05, although this was the formal (postponed) end of the project[9].

Two financial audits for this project have been conducted, one for the year 2003 and one for the year 2004. Furthermore, the project budget has been subject to the regular auditing of UNDP budgets.

Evaluation indicators for this item:

19. The actual spending on project activities was cost-effective and proportional to the projects objectives: cost-effective, and in general proportional (with the exception of the additional technical work in preparation of the Thermal standard)

20. Financial management was timely and adequate: yes, and disbursement delays are justified

### 4.2.5 Sustainability

The sustainability of the project outcomes was arranged with stakeholders during the project, which resulted in a series of good arrangements.

This issue is further discussed in section 4.3.2 Sustainability, dealing with the extent to which the benefits of the project continue after finalization of this project (and the external assistance provided with it).

### 4.2.6 Execution and implementation modalities

The UNDP country office and the executing agency DG for Urban Planning have been very successful in the selection, assignment and guidance of the project team and successful in the selection and assignment of experts and consultants.

Stakeholders have repeatedly expressed their appreciation of the project team that was created, the well-functioning of this team in the context of the project and the outstanding performance of the project manager. They also recognized the role of the UNDP country office in providing guidance to the project manager. It should be noted that UNDP engaged in weekly briefings with the project manager, thus providing a very intensive guidance. Based on stakeholder and project team feedback, this appears to be a successful formula.

The relation of the project with the executing agency (DG for Urban Planning) and other involved parties was smooth and effective. No dissatisfaction with any party was established during the evaluation meetings, and the stakeholder discussions and contributions seem to have been timely and adequately. Stakeholders identify the attention that the project manager has given to their involvement as a crucial factor in this process.

The project has gone through various difficulties, and many of these required an adjustment in activities, budgets and/or timing of the project. These adjustments have been reviewed and agreed on in a smooth process, initially between the project manager and the UNDP office, and later confirmed by the tri-partite meetings. The smooth interaction between the project team and UNDP has probably been instrumental to the relatively smooth continuation of the project, despite the various incidents.

[9] The project end date is being postponed to Dec 05, to allow for the upgrading and/or correction of some project outputs, in response to the draft final evaluation report.

The selection of an international consultant was mentioned by several stakeholders as a weak point in the UNDP involvement in the project (which was further positively regarded). UNDP, following their standard procurement rules, applied the two-tier approach in which consultants are first evaluated on their technical performance and, if this meets or exceeds a certain minimum, are selected on lowest cost only. Many stakeholders indicated that, in their opinion, this did not do justice to the technical qualities required for such project and the benefits that could be achieved by a better, but somewhat more expensive consultant. From an economic perspective, it should be noted that this procedure induces bidders to propose a minimal work package, just enough to pass the technical threshold, but including as little effort as possible, in order to keep cost down. This procedure, common to the UNDP, but not much applied elsewhere (for high-level advisory work), has lead to the selection of an underperforming consultant and severe added cost to mitigate the impact of this decision. In response to this episode, and a similar experience in another project, the UNDP country office has changed its procurement procedure and now applies a balance of technical quality versus cost, and higher technical standards, for their selection procedures. This is to be considered a good practice, especially for this type of projects.

Evaluation indicators for this item:

23. UNDP provided adequate oversight of the project and assignment of the required experts: yes, via intensive management supervision.

### *4.3 Results*

Overall, the results of the project are good, given the starting point, the context and the size of the project. This evaluation takes into account that the original purpose of the project was to build national capacities for the adoption and application of thermal standards for buildings, and this has been achieved beyond the required performance level. During the implementation of the project, the project management, in cooperation with the implementing agency and the UNDP country office, increased the scope of the project to also prepare a detailed technical analysis for the development of a thermal standard. Although this was a necessary step, the available resources for this addition did not match the approach chosen, and the output of this addition is at best marginally satisfactory.

It can reasonably be assumed that the developed and adopted Thermal standard will lead to significantly reduced building energy consumption, and reduced national greenhouse gas emissions. Due to a lack of reliable information, no quantification could be established. The reduced building energy consumption will also lead to a lower national energy demand, thus a reduced (or lower increase) in national energy imports. Since end-user energy consumption is subsidized in Lebanon, the reduced energy demand would also bring savings on these subsidies.

The Thermal standard has been developed, and has been accepted by the main stakeholders for voluntary adoption now, and mandatory adoption in 2010. Mandatory implementation, however, is not yet arranged and a legal procedure should be initiated for this step. It should be noted that the current claim is the standard is based on a sound technical / economic analysis, as is good international practice. The analysis, however, shows serious flaws which should be corrected and the consequences thereof discussed for the mandatory adoption of the standard.

Overall, the planned technical analyses did not achieve the scope and/or quality that was expected at the start of the project. The environmental and economic analysis was of a (too) limited scope, and contained several errors (which have been corrected following this evaluation). It should be considered that the resources available for these analyses were limited, and probably too limited for the purpose of the work. National energy or greenhouse gas emission analyses have not been performed and neither an analysis of the social or wider economic impacts of the Thermal standard. It should be noted that the latter two analyses are quite complicated, and it is unlikely that these would have delivered useful outputs within the scope of this project.

The various stakeholders have been properly sensitized to the concept of a thermal standard, and endorsement has been solicited, and received, from all target groups. The support for the thermal standard process in Lebanon, and the Government and civil society endorsement of it, has been of a very high level. Professional capacities for the adoption of the standard have been built, and this is further supported by various, widely available tools. Verification & enforcement capacity building has been given less attention in the project, and V&E capacities are underdeveloped. This is primarily due to the fact that a national verification infrastructure was missing, and is only now being developed. So far, however, no arrangements could be identified that specify how thermal standard compliance will be monitored in this new institutional structure.

Based on the feedback of a representative from OEA, the application of the thermal standard is encouraging, as a thermal performance matching the requirements of the standard is already occurring in a significant number of new building designs, particularly in the mountain zones. This indicates that market transformation has been initiated. Actual statistics, however, are not yet available.

The sustainability of the outcomes is very good. The project has established various arrangements with stakeholders to sustain the outcomes, and during the project several stakeholder have initiated activities that support the impact of the Thermal standard in Lebanon. So far, the initiation of the legislative procedure for mandatory adoption of the Thermal standard, and the development of a verification & enforcement system for thermal standard compliance have not been established. Both could be arranged fairly easily by the Directorate – General for Urban Planning, but so far this appears not to have been done.

The overall appreciation of the project results is good (satisfactory). Rated elements are:

- Reduce greenhouse gas emissions (Development objective 1): marginally satisfactory
- Establish thermal energy standards for buildings and prepare grounds for future adoption of the standard as an energy code for buildings (Development objective 2): satisfactory
- Initiation of a transformation in the construction industry in Lebanon (Development objective 3): highly satisfactory
- Review of the 'Thermal Building Guidelines' prepared by LIBNOR and conduct an environmental, Economic and Social Assessment of these guidelines (Immediate objective 1): marginally satisfactory
- Production of completed and agreed-upon thermal building standard document (Immediate objective 2): satisfactory
- Dissemination and sensitization of policy makers, professionals and the general public (Immediate objective 3): satisfactory
- Capacity building of resources and skilled manpower in thermal building standard adoption methods and designs and in certification and verification process for compliance (Immediate objective 4): satisfactory

### 4.3.1 Attainment of Outcomes/ Achievement of objectives (R)

The outcomes of the project are evaluated and rated separately for each of the (three) development objectives and (four) immediate objectives.

*Reduce greenhouse gas emissions (Development objective 1)*

The ultimate environmental goal of the project is the reduction of greenhouse gas emission, via the reduction of fuel and electricity demand in buildings. The actual impact of the project on national energy demand cannot be identified now, since it will take some years for the Thermal standard to gain full impact on the market, and some more years for sufficient data to become available. Instead, the expected impact of the Thermal standard after completion of the project, and including the impact of national implementation arrangements, should be compared to the project baseline.

The available calculations for building energy demand in the impact analysis are limited. The impact analysis that was available during this evaluation has later been upgraded, to provide a better overview of the expected impact of the Thermal standard in Lebanon. This included the correction of some (partly unfounded) assumptions about average impacts, but failed to separate the savings on delivered fuel and power (which would be needed for a national energy or $CO_2$-impact analysis). This addition would be needed to provide a calculation of the national impact, which is outside of the scope of this evaluation.

24. Projected emission reductions based on realised project results (baseline: annual energy saving of 0.02 MTOE pa – LogFrame Objectively Verifiable Indicators): reductions are calculated per segment of the building stock, but this has not been adequately related to national impacts. Given the aim of the project to reduce carbon emissions, this is marginally satisfactory.

Rating: marginally satisfactory

*Establish thermal energy standards for buildings and prepare grounds for future adoption of the standard as an energy code for buildings (Development objective 2)*

A Thermal standard has been developed, which is endorsed by the Lebanese Government and the main professional body for voluntary application, and future mandatory adoption. The Thermal standard targets the most significant elements of the building envelope, and has been developed

in close cooperation with national stakeholders. During various workshops and outreach events, national professionals indicated that the proposed standard would be a good step forward, and proposed a workable package of measures.

It should be noted that the technical analysis supporting the standard showed some significant errors, and it cannot be assumed that the current Thermal standard is supported by a sound technical / economic analysis. It should be noted that, following this evaluation, the analysis has been corrected on several issues, making it a limited, but sound technical / economic analysis. Additionally, the Thermal standard includes some elements which have not been part of the the energy and economic analysis. Since the current Thermal standard can be considered a good first step, which is likely to deliver significant (albeit non-quantified) energy and cost savings, this does not have to be a critical issue now. For mandatory adoption, however, it should be considered that a thorough technical analysis of all issues in such standard is considered good practice, internationally.

25. Thermal standard established and endorsed by the Lebanese Government and The Order of Engineers and Architects (LogFrame Objectively Verifiable Indicators / Means of Verification): yes, and in a very good process, but for mandatory adoption, an extension of the technical / economic analysis would be advisable.

Rating: satisfactory

*Initiation of a transformation in the construction industry in Lebanon (Development objective 3)*

Evidence of a transformation in the construction sector can only be expected in coming years. It is common, and accepted practice, that a market transformation takes time, and is initiated by a set of policies and programmes. A Thermal standard can be a very important element in such transformation, but is rarely the only component.

[Note: to following information is provisional, and needs confirmation or updating.]

[Voluntary application of the Thermal standard seems to be developing in Lebanon. According to the Order of Engineers and Architects, approx 200 out of 3000 yearly new building developments currently comply with or exceed the requirements of the Thermal standard, which is a good result in relation to the time that the (draft) standard has been circulated. In market transformation terms, this application volume indicates that the early market segment is gradually adopting the standard, which is an important and encouraging sign. It is, however, no guarantee that the majority of the market (typically beyond the first 15% of the market) will adopt the standard voluntarily as well. ]

26. Voluntary application of thermal standard (guideline) in new buildings designs and construction (LogFrame Means of Verification - adapted): yes, very encouraging results.

Rating: highly satisfactory

*Review of the 'Thermal Building Guidelines' prepared by LIBNOR and conduct an environmental, Economic and Social Assessment of these guidelines (Immediate objective 1)*

The Thermal Building Guidelines have been reviewed, and the results have been assessed by the project management. The review learned that the Guidelines were an insufficient basis for a Thermal standard, and additional work would be needed for the development of such standard. Consequently, the environmental, economic and social aspects of the Guidelines have not been assessed. An assessment of energy and end-user cost aspects of the Thermal standard has been included in the additional technical analysis (energy and economic analysis), but no national energy cost[10], greenhouse gas emissions, wider economic impact or social impact analyses. The latter two, although planned, would probably have required significantly more effort than was

[10] A very limited analysis was performed, but the quality of this analysis is too low for serious consideration.

planned for the project, and would probably have been omitted anyway. A sound national energy cost analysis (including the effects on energy subsidy and the national budget), and a greenhouse gas emissions analysis, should have been conducted. It should be noted that the energy and economic analysis had a rather small scope, and includes some errors. For this evaluation, it is not considered as a sound source of information for the end-user benefits of thermal standard adoption.

27. Assessments show national and consumer benefits of thermal guidelines / thermal standard adoption (Success criterion 2): no, the assessment of national benefits was not performed, and the analysis of consumer benefits is unsatisfactory.

28. Thermal guidelines / thermal standard are technically sound (Success criterion 3): marginally. The thermal standard is, with some exceptions, acceptable as a first step, based on good engineering practice. It is, however, not based on a sound technical analysis, nor is it likely that the recommended minimum performance values are the most economical choice on all important aspects.

29. Market transformation programmes and financing schemes developed (Output 1.4 / 1.5): no, these should have been developed by the LCECP project, in parallel to this project. However, coordination has been made with LCECP, and UNDP plans to clarify these issues in the planned LCECP project document update to make sure that these instruments will be developed in the coming period.

Rating: marginally satisfactory

*Production of completed and agreed-upon thermal building standard document (Immediate objective 2)*

The thermal standard development process has been concluded successfully. The standard document is available, and has been developed in good consultation with all relevant stakeholders. It has been accepted by the Lebanese Government and the relevant civil society parties, and is already being implemented by some building developers.

All technical documentation has been made available to the relevant parties in French and English, and all legal documents have been made available in French and English.

30. Thermal standard accepted by relevant stakeholders: LIBNOR, DG Urban Planning, Order of Engineers and Architects, Council for development and Reconstruction (Success criterion 1): yes, all stakeholders accept, and endorse the Thermal standard

31. Thermal standard available for voluntary use in English and French (Success criterion 2)[11]: Yes, the standard is available in both languages.

Rating: Satisfactory

*Dissemination and sensitization of policy makers, professionals and the general public (Immediate objective 3)*

Policy makers and professionals have been exposed frequently, and intensive, to the concept and benefits of a thermal standard. Much effort has been invested in the sensitization of policy makers and professionals to the benefits of adopting thermal performance guidelines, and this has paid off quite well. Policy makers have adopted a legal provision to support the thermal standard, and professionals endorse the voluntary application of the standard (and already apply the standard on limited scale).

[11] The project document also lists Arabic as a relevant language for the publication of the Thermal standard. Since Libnor, the national standards body, has adopted a policy that English and French documents are sufficient for technical standards, the production of an Arabic version is no longer relevant.

32. Policy makers and professionals knowledgeable of economic, environmental and social impact of thermal standard implementation (Success criterion 1): yes, and this has led them to accept the thermal standard and endorse it (in regulatory decisions, and building design, respectively)

33. Increased general public and developers' awareness of economic incentives for financing and adopting thermal building guidelines (Success criterion 3): yes for developers; no for the general public.

Rating: satisfactory

*Capacity building of resources and skilled manpower in thermal building standard adoption methods and designs and in certification and verification process for compliance (Immediate objective 4)*

Extensive attention was given to the development of capacities for the voluntary adoption of the thermal standard, especially with private sector professionals and in close collaboration with professional bodies and universities. The outputs in this area go well beyond the planned outputs of the project (including a software tool and an updated technical guide), and should be considered a valuable extension of the expected results of the project.

Verification and enforcement capacity building has been somewhat underrepresented in the project. V&E is to be considered an essential aspect of a standard development process, but its potential for success depends on the availability of a national institutional infrastructure that can take up the responsibility to verify compliance and enforce, when necessary. In this case, with an underdeveloped institutional capacity for V&E in the construction sector, it is almost impossible to develop this capacity. Verification & enforcement capacities are currently being developed, and it may be assumed that thermal standard compliance checking will be made part of that capacity. No arrangements to that effect could be identified, however.

34. Skilled human and resource capacity will have been built in the field of thermal standards in buildings in preparation for initiating a transformation of construction industry (Success criterion 2): yes, professional capacities have been developed and arrangements and tools are in place to continue this capacity building without further support in coming years.

35. An institutional mechanism is built for verification and certification of building standard compliance by developers on voluntary basis (Success criterion 3): no, a tool has been developed to support compliance checking, but the institutional infrastructure for compliance checking of building quality (and the thermal standard as a component of this) has not been developed and implemented yet. It should be noted that the objective of the project was to set up a compliance checking mechanism within a (assumed to be ready) V&E-infrastructure.

Rating: satisfactory

### 4.3.2 Sustainability

The project output is well established in the Lebanese society, and the conditions for continued progress on the issues of the thermal standard are very good. It is highly likely that, after completion of the project, the voluntary adoption of the thermal standard adoption will continue and the various involved parties will sustain their support for the improvement of the thermal performance of buildings in Lebanon.

Various elements are in place to sustain the impact of the Thermal standard development:

- The Lebanese Government has created a regulatory benefit for the voluntary adoption of the Thermal standard, in the recently adopted building law;

- The Lebanese Government is creating a verification and enforcement structure for several building quality issues. Thermal standard compliance could be added to this structure fairly easily, but arrangements have to be made;
- The Order of Engineers and Architects has taken up the dissemination and endorsement, among its members and to society as a whole, of the outputs of the project. This includes that a section of their website is permanently dedicated to the results of the project;;
- The Order of Engineers and Architects has established an energy efficiency committee, to further to cause of building energy performance within this professional body and in society;
- The American University of Beirut and the Notre Dame University have both established research groups for building energy performance, and include the concepts of the thermal standard in their regular education activities;
- The Ministry of the Environment plans to include the Thermal standard adoption in their national environmental plan;
- Various tools are in place to support the adoption of the Thermal standard by professionals;
- The Lebanese Norms Institute (LIBNOR) is processing the Thermal standard via its regular channels, for adoption as a formal Lebanese standard;
- Coordination has been made with the project Lebanese Centre for Energy Conservation Project, to communicate the benefits of better thermal performance to the public, further the market introduction of the Thermal standard and investigate options for financial instruments to support the adoption of the standard. These items, however, will need to be formally introduced in the LCECP project document update in order for LCECP to be able to take action.

Some elements have been identified that would be important to improve the sustained impact of the standard, but which have not yet been (fully) established:

- The Directorate-General for Urban Planning (DGUP) is planning for mandatory adoption of the Thermal standard in 2010. The preparations of the required legislative procedure need to be initiated;
- Verification & enforcement of the thermal standard (during voluntary and mandatory adoption) could be integrated with the planned building quality verification & enforcement capacity that is being developed by the DG Urban Planning. This would need to be arranged.

Evaluation indicators for this item:

21. The project established a sustainable impact in the country, which will continue independently: yes, the impact is very substantial and it is highly likely that this will continue independently.

22. The project established arrangements with relevant organisations or other instruments to secure a continued impact: yes, various arrangements have been made. The exception is arrangements with DG Urban Planning, regarding mandatory adoption, and integration with a new verification & enforcement structure.

# 5. Recommendations

## *5.1 Corrective actions for the design, implementation, monitoring and evaluation of the project*

The main issue for corrective action is the quality of the technical outputs for the Thermal standard. Several of the technical outputs (climate zoning report, energy and economic analysis) should not be published in their current state, and it is strongly recommended to review and upgrade these documents. This review should include:

- To generate a correct representation of the technical analyses that have been conducted, in both reports, including changes that have been made during the preparation of the analyses, and errors that have been corrected (during quality control and other national reviews) in the underlying material, but not in the final report;
- To review several technical issues, in the energy and economic analysis. This analysis appears to suffer from several limitations in the scope of the analysis, and is in its current state probably not a good basis for the development of a thermal standard. The annex Detailed technical comments regarding project outputs has been added to this report, listing the major concerns with the technical outputs;
- To reconsider, with national stakeholders, the climate zoning, and particularly the need to have two separate mountain zones. Many issues with micro-climates and the exact border between these two zones might be resolved by merging these into one, or by keeping two zones but setting the thermal standard requirements at the same level for the time being. The Thermal standard currently lists different target values for these two zones, but some of the suggested values for the high-mountain zone appear to be unrealistic, and the standard might benefit from some adaptations[12]. Keeping the requirements for the two zones similar might mitigate the need to define the border between the two zones precisely, and would allow to resolve the issue of the two zones and microclimates in a future more detailed analysis;
- To upgrade the national energy and greenhouse gas emission calculations. The current national energy calculation (in the energy and economic analysis) is not acceptable, and the omission of a greenhouse gas reduction estimate is a serious issue for an environmentally oriented project.

It should be noted that the energy and economic analysis and its report, as well as the climatic zoning report, have been significantly upgraded following this evaluation (taking into account the various issues). It can be concluded that the first two items of this recommendation have already been followed up.

A further recommendation is to clarify the (legal) status of the 'Technical guide for the application of the thermal standard for buildings in Lebanon' and of the draft report 'Climate and Comfort; passive design strategies for Lebanon'. The 'technical guide…' lists several issues which are not included in the Thermal standard (e.g., waterproofing, air tightness and ventilation), but also information about compliance paths. It should be unambiguous which elements are part of the standard, and which are additional elements. The 'Climate and Comfort' report provides a good overview of thermal comfort issues and the thermal performance of buildings, but applying a rather different approach which is difficult to combine with the thermal standard approach.

To secure the long-term impact of the Thermal standard, it is recommended to agree a plan, with the DG for Urban Planning, on the integration of thermal standard compliance checking with the building quality verification & enforcement structure that is currently being developed. Such plan could include the training materials and tools that would be needed for inspectors, and training

[12] These issues are described in the annex Detailed technical comments regarding project outputs.

sessions or other means of interaction to train inspectors for the task of verifying compliance with the Thermal standard, and should identify the capacities and resources required for such actions.

A last recommendation is to formalize a monitoring structure for the voluntary (and later mandatory) adoption of the Thermal standard. Both the DG Urban Planning and the Order of Engineers and Architects have developed suggestions for this monitoring, and it is important to coordinate the efforts of both parties and to have a structured monitoring system in place as soon as possible.

### *5.2 Actions to follow up or reinforce initial benefits from the project*

A simple means to raise the profile of the Thermal standard, and stimulate consideration of voluntary adoption by *all* building developers would be to include an item about (voluntary) application of the Thermal standard at the formal building permit application form. This option, suggested by the Order of Engineers and Architects, would be a simple, but probably very effective tool to reinforce the training and dissemination of information about the standard.

Demonstration projects, of buildings that have applied the Thermal standard requirements, would be a good instrument to disseminate the benefits of the Thermal standard to the construction sector (in the construction sector, often only seeing is believing). By also measuring the performance of these buildings, a comparison of calculated versus real life performance could be established, which is important for the impact assessment of the standard as well as for future policy decisions.

Dissemination of the benefits of the Thermal standard could further be improved by awareness raising campaigns about the Thermal standard, separately for the professional audience (via the regular channels for professional communication, like magazines and the Order of Architects and Engineers), but for the general public it might be preferable to integrate the message with other home or office energy conservation messages. The Lebanese Centre for Energy Conservation Project has already agreed to develop such approach for the general public, and their efforts could be further supported, although a formal introduction in their project document would be needed for them to be able to commence these activities.

The current thermal standard has a weak basis in the current energy and economic analysis. The analysis was of a rather limited scope, with only one building type modeled, not all building components included in the modeling, life cycle cost calculations based on energy prices well below the current market price, no regard of ventilation / air infiltration or thermal bridges etc. Before mandatory adoption of the Thermal standard, it is recommended to upgrade this standard by repeating the previous calculations with an upgraded modeling, more data and for more building typologies, to include all major aspects of building envelope thermal performance, to update the price characteristics and to include the first experiences with the adoption of the Thermal standard in buildings. In parallel, the climate zoning should be reviewed, taking into account the experience with implementation, and specifically the issue of micro-climates and the borders between zones, and the availability of new, more detailed data.

Such analysis could primarily be performed by national parties (e.g., American University of Beirut, Notre Dame University, Order of Engineers and Architects), who have developed good capacities during this project. It would be advisable, however, to seek the advice of high-level international experts, with a good track record in developing building energy codes (in their own country), on modeling issues and other issues in the approach of such analysis. The analysis could also include issues for future consideration (listed in the following section).

### *5.3 Proposals for future directions underlining main objectives*

The first, and obvious recommendation for future directions in the energy performance of buildings, is to elaborate the current approach into an energy performance standard for buildings. This is the typical next stage in regulating building energy demand, usually following a first stage (of envelope insulation characteristics) after five to ten years. A building energy performance

standard typically integrates building envelope performance with equipment energy efficiency requirements, and often takes the format of a maximum energy demand (for cooling and/or heating) per square meter of interior area (GJ/m$^2$.year). Such target value is usually adapted to climate zones and building types (residential buildings, offices, hospitals etc), and can be gradually lowered over the years, to further stimulate market transformation. The application of such target value allows for compensation between the energy performance of individual components, and gives maximum flexibility (also for lowest cost solutions) to the building developer while making sure that the energy performance is at the desired level.

In such stage, it could be considered to also include new additions (of a certain minimum size) to existing buildings in the regulations, thus extending the scope of the regulation and maximizing national and end-user benefits.

A second logical follow-on to further the energy performance of buildings would be to work on HVAC equipment, appliances and lighting. Especially installed equipment (boilers, water heaters, air conditioners etc) are closely linked to the energy demand for heating and cooling buildings. Further, appliances (domestic appliances, office equipment etc) and lighting typically provide large savings potentials, which are further increased because efficient appliance and lighting typically reduce the cooling demands of buildings, which can lead to (much) higher energy savings in cooling-dominated climates. International experience learns that large national benefits can be generated from appliance and equipment standards and labels, and market transformation programs for these products. In the context of Lebanon, it is recommended to specifically review the potential of air conditioning regulations (standards, labels, programs) and water heaters. Air conditioning is a large source of building energy demand, and energy efficiency improvements in this area can often bring quick and relatively easy energy demand and energy cost benefits. Air conditioning efficiency is further known for its disproportional, positive impact on reducing peak power demand, which is important in countries with limited available power and frequent outages. Water heating is currently often a cumbersome process in Lebanese households. It could be considered if a solar boiler program would be an option to improve quality of life to residents, whilst preventing the uptake of other fuel- or electricity-driven water heating equipment. Such program might not appear to save much energy against the current baseline, but probably would do so if it is considered that economic development usually brings disproportionately more energy-using equipment and energy demand.

A third possible follow-on to the work on the Thermal standard would be a program to bring local building material manufacturing up to international quality levels, and to certify these products according to internationally recognized standards (preferably EN test standards). This would have little impact on the energy performance of buildings in Lebanon as such (general construction materials have only a small impact on the thermal performance of buildings, and proxy information would suffice for the calculation of thermal performance when locally manufactured, non-certified materials are used), but it would enable the Lebanese building materials industry to compete on an equal level with international suppliers, on the domestic and regional markets.

# 6. Lessons learned

The project, including its design, implementation and results, shows many insightful lessons. Many of these lessons point to excellent aspects of the project, and repetition of the underlying practices in other projects would be recommended. Some point to clear failures in this project, and also provide very useful lessons for future projects. It is impossible to provide a full overview of all lessons learned here, and the project management and the stakeholders involved are encouraged to describe their lessons learned, and report these (e.g., as part of the project final report, in a conference or magazine paper).

Remarkable practices include:

- Excellent, intensive involvement of stakeholders throughout the project.

  Stakeholder involvement in the project has been remarkably high, and this has had a very positive impact on the projects focus, implementation success and the relevance of the outputs for the country. Various arrangements have been made to stimulate stakeholder involvement:

  - A project steering group included all stakeholder groups, and was involved in all decision during the project. The level of involvement of participants was adapted to the issues that were relevant during that stage of the project (e.g., private sector involvement particularly when issues with a direct impact on the construction sector were being discussed). Parties were also involved via bilateral contacts and email, to brief about meetings which they couldn't attend, invite feedback to new developments or outputs and discuss implementation issues;
  - The involvement of key national stakeholders in the development of project outputs. Throughout the project, cooperation with national stakeholders in the development of technical and capacity building outputs has been significant, and successful. National stakeholders have taken responsibility for the development of some of the outputs, have been very active in the promotion of the project in their networks, with use of their resources, and have been involved in the 'selling' of the project outputs to policy makers;
  - Supporting that stakeholders develop their own links and usages of the project outputs. Universities and professional bodies have set-up their own activities alongside the project, making use of the project outputs also for their own purposes. This has been encouraged, and has resulted in a very significant improvement in the national capacity for thermal standard implementation and a good national basis for future work on building energy performance.

  The success of the stakeholder involvement can be explained by these arrangements, and the open and informative management and communication style of the project management. These elements alone are to be considered a good practice, and in combination it is a very commendable practice, which should be repeated in similar projects.

- Institutional and personal project champions

  This project would not have been this successful if it had not been adopted by two project champions. The Lebanese Order or Engineers and Architects has fully endorsed this project, has made several resources available and taken up this project in its public outreach as their own responsibility. This makes them a project champion, represented by the leadership of the OEA. Leadership changes during the project did not alter that position, indicating a deep commitment to the cause of the project. The role of the OEA in this project has been crucial; without their endorsement, this project would have had a rather different impact in the country. Significant attention has been given to the involvement of the OEA in the project, from the earliest stages on, and this has been

maintained throughout the project. The establishment of such national project champion is crucial to a project, and this should be an element in future projects too.

The project team itself also had its champion. The project manager, Matilda El-Khoury, has provided personal leadership in the implementation of the Thermal standard, going well beyond her professional duties. Such leadership is essential to a complex new development, especially in the demanding project environment of Lebanon. It is difficult to institutionalize such leadership, but it should be attempted to recruit a project manager with such capacities, and motivation, for future projects.

- Reality checking and technical backstopping on all project outputs

  The development of building regulations is typically hindered by the (limited) availability of data, the relative underreporting of existing construction practices, the complexity of buildings (especially when compared to the technical expertise available in the construction industry), and the fact that these regulations are a new element for the country. This implies that some form of reality checking is needed, to make sure that the modeled outputs of technical analysis reasonably reflect the actual situation. Qualified professionals can make such assessments, and in this project, universities and professional bodies have been very active in providing expert feedback on the reality of project outputs. This has safeguarded that the project outputs are in general technically acceptable, even though the underlying analysis has been subject to severe difficulties.

  The development of energy efficiency regulations for buildings has also proven to be a rather demanding task, which probably requires more expertise and experience than was expected at the start of the project (and available in the international consultancy team). An analysis is always a compromise between the richness of aspects that would need to be included for a full analysis, and the practical limitations of resources, timing and capacities. Technical backstopping and quality control had to be provided on the outputs of this technical analysis, and several adjustments have been made during project implementation. This has proven to be very valuable, and has improved the quality and relevance of the outputs. For future projects, it is recommended to repeat such approach, including national stakeholders for reality checking and quality control, but also to include some international expertise (independent of main contractors), especially on modeling issues and the overall approach of the analysis.

- In-depth assessment of national regulatory infrastructure

  New regulatory policy, like a thermal standard, is typically characterized by its reliance on other regulatory and institutional aspects. In this case, it is typically dependent on a national building policy, building permit procedures, design and construction compliance checking, product quality assurance, and many more factors. It deviates significantly from other, non-regulatory projects in that many of these aspects are a government prerogative, and it is usually impossible to mitigate any missing elements by project activities. The analysis of this institutional and regulatory framework, as part of the project design, has been limited. A crucial element, the availability of a national verification and enforcement infrastructure, had been – incorrectly – assumed. This presented the project later on with an impossible objective (to build capacities within this structure for thermal standard compliance checking). In future project, into building standards or other regulatory policies, more attention should be given to the regulatory and institutional environment, and activities designed, in good cooperation with the relevant institutions, to upgrade this setting where needed.

# Evaluation report Annexes

## *Annex 1 Terms of Reference For Final project Evaluation*

Project 00013379 “Capacity Building For the Adoption and Application of Thermal Standards for Buildings”

I. Introduction

The final evaluation is intended to assess the relevance, performance and success of the project. It will look at early signs of potential impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals.

The final evaluation will also identify/document lessons learned and will make recommendations that might improve the design and implementation of other UNDP/GEF projects. Furthermore, the final evaluation will make forward vision recommendations related to the sustainability of project outputs.

II. Project Description

Project "Capacity Building for the Adoption and Application of Thermal Standards for Buildings" is funded by the Global Environment Facility (GEF), managed by the United Nations Development Program (UNDP), and executed under the Lebanese General Directorate of Urban Planning (DGUP).

The project falls under the Climate Change focal area, and aims at enabling energy conservation in Buildings through the establishment of a Thermal Standard for Buildings in Lebanon, and the provision of capacity building and information dissemination to enable its future adoption and application.

III. Objectives of the Evaluation

The purpose of the consultancy is to conduct a final project evaluation. The evaluation has been initiated by UNDP in accordance with UNDP/GEF M&E policies and procedures, where a medium-sized project supported by the GEF should undergo a final evaluation upon completion of implementation.

The objectives of the Final Evaluation are:

i) To evaluate the project results and impacts;

ii) To promote accountability for resource use;

iii) To document, provide feedback on, and disseminate lessons learned; and

iv) To provide forward vision recommendations to complement and sustain project outputs.

The main stakeholders of the evaluation are:

- United Nations Development Programme
- General Directorate of Urban Planning
- Council for Development and Reconstruction
- Order of Engineers and Architects – Beirut
- Lebanese Standards Institution

IV. Scope of the Evaluation

The scope of the evaluation includes the review and assessment of the Project’s formulation, implementation and results. In addition to a descriptive assessment, all criteria marked with (R)

should be rated using the following divisions: Highly Satisfactory, Satisfactory, Marginally Satisfactory, Unsatisfactory. (Annex 1)

The following is a breakdown of the Evaluation scope and components:

1. Executive summary

- Brief description of project
- Context and purpose of the evaluation
- Main findings, conclusions, recommendations and lessons learned

2. Introduction

- Purpose of the evaluation
- Key issues addressed
- Methodology of the evaluation
- Structure of the evaluation

3. The project and its development context

- Project start and duration
- Problems that the project seeks to address
- Immediate and development objectives of the project
- Main stakeholders
- Results expected

4. Findings and Conclusions

4.1 - Project Formulation

Conceptualization/Design (R). This should assess the approach used in design and an appreciation of the appropriateness of problem conceptualization and whether the selected intervention strategy addressed the root causes and principal threats in the project area. It should also include an assessment of the logical framework and whether the different project components and activities proposed to achieve the objective were appropriate, viable and responded to contextual institutional, legal and regulatory settings of the project. It should also assess the indicators defined for guiding implementation and measurement of achievement and whether lessons from other relevant projects (e.g., same focal area) were incorporated into project design.

Country-ownership/Driveness: Assess the extent to which the project idea/conceptualization had its origin within national, sectoral and development plans and focuses on national environment and development interests.

Stakeholder participation (R) Assess information dissemination, consultation, and "stakeholder" participation in design stages.

Replication approach: Determine the ways in which lessons and experiences coming out of the project were/are to be replicated or scaled up in the design and implementation of other projects (this also related to actual practices undertaken during implementation).

UNDP comparative advantage: The consideration of linkages between projects and other interventions within the sector and the definition of clear and appropriate indicators and management arrangements at the design stage.

4.2 - Project Implementation

Implementation Approach (R): This should include assessments of the following aspects:

- The use of the logical framework as a management tool during implementation and any changes made to this as a response to changing conditions and/or feedback from M and E activities if required;
- Other elements that indicate adaptive management such as comprehensive and realistic work plans routinely developed that reflect adaptive management and/or; changes in management arrangements to enhance implementation;
- The project's use/establishment of electronic information technologies to support implementation, participation and monitoring, as well as other project activities;
- The general operational relationships between the institutions involved and others and how these relationships have contributed to effective implementation and achievement of project objectives;
- Technical capacities associated with the project and their role in project development, management and achievements;

Monitoring and evaluation (R): Including an assessment as to whether there has been adequate periodic oversight of activities during implementation to establish the extent to which inputs, work schedules, other required actions and outputs are proceeding according to plan; whether formal evaluations have been held and whether action has been taken on the results of this monitoring oversight and evaluation reports.

Stakeholder participation (R): This should include assessments of the mechanisms for information dissemination in project implementation and the extent of stakeholder participation in management, emphasizing the following:

- The production and dissemination of information generated by the project;
- Local resource users and NGOs participation in project implementation and decision making and an analysis of the strengths and weaknesses of the approach adopted by the project in this arena;
- The establishment of partnerships and collaborative relationships developed by the project with local, national and international entities and the effects they have had on project implementation;
- Involvement of governmental institutions in project implementation, the extent of governmental support of the project;

Financial Planning: Including an assessment of:

- The actual project cost by objectives, outputs, activities
- The cost-effectiveness of achievements
- Financial management (including disbursement issues)

Sustainability: Extent to which the benefits of the project will continue, within or outside the project domain, after it has come to an end. Relevant factors include for example: development of a sustainability strategy, mainstreaming project objectives into the economy or community production activities.

Execution and implementation modalities: This should consider the effectiveness of the UNDP counterpart and Project Co-ordination Unit participation in selection, recruitment, assignment of experts, consultants and national counterpart staff members and in the definition of tasks and responsibilities; quantity, quality and timeliness of inputs for the project with respect to execution responsibilities, enactment of necessary legislation and budgetary provisions and extent to which these may have affected implementation and sustainability of the Project; quality and timeliness of inputs by UNDP and GoC and other parties responsible for providing inputs to the project, and the extent to which this may have affected the smooth implementation of the project.

4.3 - Results

Attainment of Outcomes/ Achievement of objectives (R): Including a description and rating of the extent to which the project's objectives (environmental and developmental) were achieved using Highly Satisfactory, Satisfactory, Marginally Satisfactory, and Unsatisfactory ratings. If the project did not establish a baseline (initial conditions), the evaluators should seek to determine it through the use of special methodologies so that achievements, results and impacts can be properly established.

Sustainability: Including an appreciation of the extent to which benefits continue, within or outside the project domain after GEF assistance/external assistance in this phase has come to an end.

5 - Recommendations

- Corrective actions for the design, implementation, monitoring and evaluation of the project;
- Actions to follow up or reinforce initial benefits from the project;
- Proposals for future directions underlining main objectives;

6 - Lessons learned

This should highlight the best and worst practices in addressing issues relating to relevance, performance and success.

7 - Evaluation report Annexes

- Evaluation TORs
- Itinerary
- List of persons interviewed
- List of documents reviewed
- Comments by stakeholders (only in case of discrepancies with evaluation findings and conclusions)

V. Products Expected from the Evaluation

The product expected from this evaluation is one evaluation report detailing the findings, assessment of performance, lessons learned, recommendations, description of best practices, etc. The report should not exceed 50 pages in total, and should be submitted to the UNDP Lebanon country Office. The first draft of the report is to be submitted within two weeks of completion of the mission to Lebanon. The report will be circulated by UNDP to the government counterpart, project management, and other key stakeholders, for comments and feedback. If there are discrepancies between the impressions and findings of the evaluator and the aforementioned parties these should be explained in an annex attached to the final report. The final report is to be submitted within two weeks of the receipt of feedback from UNDP.

The Evaluation Report should be structured along the following lines:

- Executive summary
- Introduction
- The project and its development context
- Findings and Conclusions
    - Project formulation
    - Implementation

- Results

- Recommendations
- Lessons learned
- Annexes

VI. Methodology or Evaluation Approach

The methodology to be used for the evaluation will consist of:

a) Desk review of project documentation (Annex 2), including:

- Project Document;
- Annual Project Progress Reports;
- Project Outputs (Climatic Zoning for Buildings in Lebanon, Energy Analysis and Economic Feasibility Study, Thermal Standard for Buildings in Lebanon, Technical Guide, Software tool, etc.)

b) Undertaking one mission to Lebanon, conducting interviews with project management and stakeholders, and conducting a final debriefing meeting with UNDP country office. The list of interviews will include:

- Project Manager
- United Nations Development Programme
- General Directorate of Urban Planning
- Council for Development and Reconstruction
- Order of Engineers and Architects – Beirut
- Lebanese Standards Institution
- Project Consultant

c) Preparation of Draft Evaluation Report and final Evaluation Report

VII. Evaluation Team

The Evaluation will be conducted by one evaluator with the following background and areas of expertise:

- Climate Change
- Energy Building Codes
- Climatic Zoning
- Energy Efficiency and energy Saving

The Evaluator will be responsible for all tasks set in the terms of reference including the desk review of project documentation, the mission to Lebanon, the interviews with stakeholders, and the drafting and finalization of the evaluation report.

VIII. Implementation Arrangements

- Management arrangements:

  UNDP country offices will set-up the meeting schedule/agenda with stakeholders.

- Evaluation time frame:
  - Desk review 4 Man-days
  - Mission (including travel), interviews, de-briefing 5 Man-days

- Preparation of Draft Evaluation Report 5 Man-days
- Preparation of Final Evaluation report 2 Man-days

- Resources required:

  The resources required are one Consultant for a total of 16 man-days, inclusive of desk review of project documentation, one mission to Lebanon (air travel) and meetings with stakeholders within the Beirut area.

Annex 1 to the Terms of Reference for Final project evaluation

*Explanation on Terminology Provided in the GEF Guidelines to Terminal Evaluations*

Implementation Approach includes an analysis of the project's logical framework, adaptation to changing conditions (adaptive management), partnerships in implementation arrangements, changes in project design, and overall project management.

Some elements of an effective implementation approach may include:

- The logical framework used during implementation as a management and M&E tool
- Effective partnerships arrangements established for implementation of the project with relevant stakeholders involved in the country/region
- Lessons from other relevant projects (e.g., same focal area) incorporated into project implementation
- Feedback from M&E activities used for adaptive management.

Country Ownership/Driveness is the relevance of the project to national development and environmental agendas, recipient country commitment, and regional and international agreements where applicable. Project Concept has its origin within the national sectoral and development plans

Some elements of effective country ownership/driveness may include:

- Project Concept has its origin within the national sectoral and development plans
- Outcomes (or potential outcomes) from the project have been incorporated into the national sectoral and development plans
- Relevant country representatives (e.g., governmental official, civil society, etc.) are actively involved in project identification, planning and/or implementation
- The recipient government has maintained financial commitment to the project
- The government has approved policies and/or modified regulatory frameworks in line with the project's objectives

For projects whose main focus and actors are in the private-sector rather than public-sector (e.g., IFC projects), elements of effective country ownership/driveness that demonstrate the interest and commitment of the local private sector to the project may include:

- The number of companies that participated in the project by: receiving technical assistance, applying for financing, attending dissemination events, adopting environmental standards promoted by the project, etc.
- Amount contributed by participating companies to achieve the environmental benefits promoted by the project, including: equity invested, guarantees provided, co-funding of project activities, in-kind contributions, etc.
- Project's collaboration with industry associations

**Stakeholder Participation/Public Involvement** consists of three related and often overlapping processes: information dissemination, consultation, and "stakeholder" participation. Stakeholders are the individuals, groups, institutions, or other bodies that have an interest or stake in the outcome of the GEF-financed project. The term also applies to those potentially adversely affected by a project.

Examples of effective public involvement include:

Information dissemination

- Implementation of appropriate outreach/public awareness campaigns

Consultation and stakeholder participation

- Consulting and making use of the skills, experiences and knowledge of NGOs, community and local groups, the private and public sectors, and academic institutions in the design, implementation, and evaluation of project activities

Stakeholder participation

- Project institutional networks well placed within the overall national or community organizational structures, for example, by building on the local decision making structures, incorporating local knowledge, and devolving project management responsibilities to the local organizations or communities as the project approaches closure
- Building partnerships among different project stakeholders
- Fulfillment of commitments to local stakeholders and stakeholders considered to be adequately involved.

**Sustainability** measures the extent to which benefits continue, within or outside the project domain, from a particular project or program after GEF assistance/external assistance has come to an end. Relevant factors to improve the sustainability of project outcomes include:

- Development and implementation of a sustainability strategy.
- Establishment of the financial and economic instruments and mechanisms to ensure the ongoing flow of benefits once the GEF assistance ends (from the public and private sectors, income generating activities, and market transformations to promote the project's objectives).
- Development of suitable organizational arrangements by public and/or private sector.
- Development of policy and regulatory frameworks that further the project objectives.
- Incorporation of environmental and ecological factors affecting future flow of benefits.
- Development of appropriate institutional capacity (systems, structures, staff, expertise, etc.).
- Identification and involvement of champions (i.e. individuals in government and civil society who can promote sustainability of project outcomes).
- Achieving social sustainability, for example, by mainstreaming project activities into the economy or community production activities.
- Achieving stakeholders' consensus regarding courses of action on project activities.

**Replication approach**, in the context of GEF projects, is defined as lessons and experiences coming out of the project that are replicated or scaled up in the design and implementation of other projects. Replication can have two aspects, replication proper (lessons and experiences are replicated in different geographic area) or scaling up (lessons and experiences are replicated

within the same geographic area but funded by other sources). Examples of replication approaches include:

- Knowledge transfer (i.e., dissemination of lessons through project result documents, training workshops, information exchange, a national and regional forum, etc).
- Expansion of demonstration projects.
- Capacity building and training of individuals, and institutions to expand the project's achievements in the country or other regions.
- Use of project-trained individuals, institutions or companies to replicate the project's outcomes in other regions.

**Financial Planning** includes actual project cost by activity, financial management (including disbursement issues), and co-financing. If a financial audit has been conducted the major findings should be presented in the TE.

Effective financial plans include:

- Identification of potential sources of co-financing as well as leveraged and associated financing[13].
- Strong financial controls, including reporting, and planning that allow the project management to make informed decisions regarding the budget at any time, allows for a proper and timely flow of funds, and for the payment of satisfactory project deliverables
- Due diligence due diligence in the management of funds and financial audits.

*Co financing includes:* Grants, Loans/Concessional (compared to market rate), Credits, Equity investments, In-kind support, Other contributions mobilized for the project from other multilateral agencies, bilateral development cooperation agencies, NGOs, the private sector and beneficiaries. Please refer to Council documents on co-financing for definitions, such as GEF/C.20/6.

*Leveraged resources* are additional resources—beyond those committed to the project itself at the time of approval—that are mobilized later as a direct result of the project. Leveraged resources can be financial or in-kind and they may be from other donors, NGO's, foundations, governments, communities or the private sector. Please briefly describe the resources the project has leveraged since inception and indicate how these resources are contributing to the project's ultimate objective.

**Cost-effectiveness** assesses the achievement of the environmental and developmental objectives as well as the project's outputs in relation to the inputs, costs, and implementing time. It also examines the project's compliance with the application of the incremental cost concept. Cost-effective factors include:

- Compliance with the incremental cost criteria (e.g. GEF funds are used to finance a component of a project that would not have taken place without GEF funding.) and securing co-funding and associated funding.
- The project completed the planned activities and met or exceeded the expected outcomes in terms of achievement of Global Environmental and Development Objectives according to schedule, and as cost-effective as initially planned.
- The project used either a benchmark approach or a comparison approach (did not exceed the costs levels of similar projects in similar contexts)

[13] Please refer to Council documents on co-financing for definitions, such as GEF/C.20/6. The following page presents a table to be used for reporting co-financing.

**Monitoring & Evaluation**. Monitoring is the periodic oversight of a process, or the implementation of an activity, which seeks to establish the extent to which inputs, work schedules, other required actions and outputs are proceeding according to plan, so that timely action can be taken to correct the deficiencies detected. Evaluation is a process by which program inputs, activities and results are analyzed and judged explicitly against benchmarks or baseline conditions using performance indicators. This will allow project managers and planners to make decisions based on the evidence of information on the project implementation stage, performance indicators, level of funding still available, etc, building on the project's logical framework.

Monitoring and Evaluation includes activities to measure the project's achievements such as identification of performance indicators, measurement procedures, and determination of baseline conditions. Projects are required to implement plans for monitoring and evaluation with adequate funding and appropriate staff and include activities such as description of data sources and methods for data collection, collection of baseline data, and stakeholder participation. Given the long-term nature of many GEF projects, projects are also encouraged to include long-term monitoring plans that are sustainable after project completion.

Annex 2 to the Terms of Reference for Final project evaluation

*List of Documents to be reviewed by the Evaluator*

- Project Document
- Annual Project Progress Reports
- Key Project Outputs:
  - Climatic Zoning for Buildings in Lebanon
  - Energy Analysis and Economic Feasibility Study
  - Thermal Standard for Buildings in Lebanon
  - Technical Guide
  - Software tool

## *Annex 2 Evaluation itinerary*

The itinerary followed is described in the evaluation outline developed for this evaluation, which is repeated here.

### 1. Introduction

This evaluation outline describes the approach proposed for the evaluation of the UNDP/GEF project "Capacity Building For the Adoption and Application of Thermal Standards for Buildings", the assessment of its contribution to capacity development and global environmental goals, and the identification of lessons learned, recommendations for future projects and forward vision recommendations regarding the sustainability of project outputs.

### *1.1 Background for this Evaluation*

The project "Capacity Building for the Adoption and Application of Thermal Standards for Buildings" (further: the project) is funded by the Global Environment Facility (GEF), managed by the United Nations Development Program (UNDP), and executed under the Lebanese General Directorate of Urban Planning (DGUP). The project falls under the Climate Change focal area, and aims at enabling energy conservation in Buildings through the establishment of a Thermal Standard for Buildings in Lebanon, and the provision of capacity building and information dissemination to enable its future adoption and application.

To evaluate the project results and impacts; promote accountability for resource use; document, provide feedback on and disseminate lessons learned; and provide forward vision recommendations to complement and sustain project outputs, UNDP requests this final project evaluation. This outline describes the proposed approach for this evaluation and its strategy, planning and deliverables, in accordance with the Terms of Reference provided by UNDP.

### *1.2 Evaluation Issues*

The ToR describe the issues that need to be addressed in the final evaluation, the documents to be reviewed and the stakeholders to be consulted. For some of the evaluation components (specifically Findings and Conclusions), the ToR specify which elements need to be addressed in the evaluation.

The evaluation should include the following issues (a full description of these issues is included as Annex I). Items marked with an (R) should also be rated in one of four classes.

1. Executive summary
   - Brief description of project
   - Context and purpose of the evaluation
   - Main findings, conclusions, recommendations and lessons learned
2. Introduction
   - Purpose of the evaluation
   - Key issues addressed
   - Methodology of the evaluation
   - Structure of the evaluation
3. The project and its development context
   - Project start and duration
   - Problems that the project seeks to address
   - Immediate and development objectives of the project
   - Main stakeholders
   - Results expected
4. Findings and Conclusions

   4.1 Project Formulation

- Conceptualization/Design (R)
- Country-ownership/Driveness
- Stakeholder participation (R)
- Replication approach
- UNDP comparative advantage

4.2 Project Implementation
- Implementation Approach (R)
- Monitoring and evaluation (R)
- Stakeholder participation (R)
- Financial Planning
- Sustainability
- Execution and implementation modalities

4.3 Results
- Attainment of Outcomes/ Achievement of objectives (R)
- Sustainability

5 Recommendations
- Corrective actions for the design, implementation, monitoring and evaluation of the project;
- Actions to follow up or reinforce initial benefits from the project;
- Proposals for future directions underlining main objectives;

6 Lessons learned
- This should highlight the best and worst practices in addressing issues relating to relevance, performance and success.

These evaluation issues form the basis for the proposed evaluation. The projects relevance, performance and success, as well as emerging impact and sustainability of results, will be assessed against indicators for the above issues.

These indicators will be taken from the Project Document, as far as possible, supplemented with additional indicators where needed. A full list of evaluation indicators will be prepared at the start of the evaluation, based on the above issues, and the project documentation. It should be noted that the availability of information, and the limitations in time and budget for the evaluation will limit the extend to which evaluation indicators can be assessed. The indicators will provide the framework for the fact finding, analysis, ratings and recommendations of the evaluation.

### *1.3 Organization and approach of the evaluation*

This evaluation will be performed as an external, independent assessment of the project, including a desk review of available project documentation (including the project document, progress reports, outputs and other sources of information), interviews with UNDP and DGUP program officers, the project manager, the project consultant, and stakeholders (Council for Development and Reconstruction, Order of Engineers and Architects, Lebanese Standards Institute). These interviews will take place during a (one-week) visit to Beirut. Further information will be gathered by telephone interviews and email enquiries to the people involved in the project. External experts may be contacted to gather background information or references and to check project data.

## 2. Evaluation Strategy

This evaluation aims at assessing the projects relevance, performance and success, early signs of impact and sustainability of results, identifying lessons learned, and making recommendations for the sustainability of project outputs and for future projects . For this, evaluation indicators will be developed, based on the evaluation issues stated in paragraph 1.2. The indicators are intended to measure the performance, management and impact of the project and will guide the evaluation process.

### *2.1 Evaluation Indicators*

Evaluation indicators serve to measure the performance of the project on several aspects. An indicator targets an important, measurable aspect of an evaluation issue, with the aim to make a complex, principally qualitative issue measurable and (semi-) quantifiable. During the evaluation, fact-finding focuses on collecting data regarding these indicators (next to general qualitative and contextual information about the project), and during the analysis the projects results are valued against indicators (ranging from below to above what has been / might have been expected or was implied in the project design). Given the extent of the project and the complexity of the subject, not all aspects (of all issues) can be targeted during this evaluation. The evaluation indicators will therefore be selected to cover a large proportion of the project, but the availability of data and access to information sources will be taken into account. The evaluation indicators will be developed in close co-operation with UNDP program officers.

Although monitoring and evaluation is often a part of a project design, and ideally an integrated management tool, usually not all relevant evaluation aspects where foreseen at the initiation of a project and duly monitored during project execution. Additionally, a final evaluation often includes issues (specifically about project design and impact / outcome) that are of lesser relevance during project execution and can only be assessed ex-post. Therefore, it is often needed to develop additional indicators to assess project design issues, the impact on stakeholders and the long-term impact (or early signs of this) of the project. These will be developed during the desk review of the project documentation, based on the (listed) evaluation issues. Draft evaluation indicators will be presented to the program officers and executors for review and comments, before these are finalized.

The development of the evaluation indicators will be structured according to the following system:

<table>
<tr><th>Activity</th><th>I Direct output</th><th>II Direct effects</th><th>III External effects</th><th>IV Final outcome</th></tr>
<tr><td>Project activity A</td><td>Direct result (e.g. report or standard published, website developed) of one activity</td><td rowspan="2">Indirect result / effect on target group (e.g. report or standard used by target group, website used by target group) of one or a few activities</td><td rowspan="3">External results in targeted countries (e.g. adoption of building code legislation, installation of enforcement infrastructure, based on reports or building codes, websites, training etc) as a result of a group of activities</td><td rowspan="3">Final results in targeted countries (e.g. transformation of building market, changes in thermal performance of buildings, $CO_2$-emission reductions) as a result of the whole project</td></tr>
<tr><td>Project activity B</td><td></td></tr>
<tr><td>Project activity C</td><td></td><td></td></tr>
<tr><td>Etc</td><td></td><td></td><td></td><td></td></tr>
</table>

Category I direct outputs are usually monitored through progress reports (as they are normally a direct output of the work to be done) and do not require specifically designed evaluation indicators. These outputs are usually delivered during the course of the project, can easily be observed and give an indication of the efficiency of the project.

Category II direct effects are usually a direct effect of activities, but are often not measured during the course of a project (though they could provide valuable information to the program management). These effects can usually be observed during or shortly after the completion of an activity, can be measured by enquiries, surveys, interviews etc and give an indication of the efficiency of the project.

Category III external effects are an indirect result of project activities. These are usually (for projects like the development of thermal standards / building codes) the result of activities that target groups in target countries engage in as a result of project activities (e.g. government adopting thermal standard / building code legislation following participation in the project). These

effects are usually more difficult to monitor, as they occur some time after completion of activities (typical time delays differ a lot, but a six months to one year delay would be a reasonable assumption) and are usually the result of more inputs (one being the project). External effects can be measured in a variety of ways, including interviews, surveys, observations, dependent on the type of effect, and give an indication of the effectiveness of the project.

Category IV final outcome is the final effect of the project in a target country (the market situation, building stock, energy consumption, etc). These are usually long-term effects of projects and can only be measured after longer periods (typically starting after three to five years, with effects lasting more than 10 years). Possible measurements include building market and building stock analyses and energy consumption analysis, but it can be difficult to prove a direct relationship between project activities and changes in market and stock. The final outcome is always the result of many activities, can give an indication of the effectiveness of a project but is not always very helpful for an evaluation of a single project.

Since the details of the 'Capacity Building for the Adoption and Application of Thermal Standards for Buildings' project are not yet known, it is difficult to indicate whether observable effects can be expected in all categories. Based on the information provided, and on an understanding of the typical development of building standards, it may be expected that there will be observable effects in category I (direct outputs), category II (direct effects) and category III (external effects). It is unlikely that the Final outcomes (category IV) will be substantial, although it may be possible (dependent on the project duration and the results achieved) that there are indications of early effects in the market. Directly observable effects in the building stock (and resulting carbon emissions) will likely be impossible to observe, although it may be possible to calculate the likely long-term impact of a thermal standard development in these fields.

Direct outputs can be evaluated by a comparison to the deliverables and output stated in the project document and usually do not require the definition of additional evaluation indicators. It will be analyzed whether the project document includes the necessary indicators covering category III external effects (where relevant and feasible) and category II effects (for other subjects), which will then be adopted as evaluation indicators for the evaluation issues. If needed, additional indicators will be developed, as described before.

Given the scope of this evaluation, the number of indicators will be limited to one or two (max. three) per evaluation issue, with more focus on (and more than one indicator for) issues that require a (semi-quantitative) rating next to a (qualitative) assessment.

*Data collection and Analysis*

The proposed approach for this evaluation will include three main components:

- The desk review of (all kinds of) project documentation, including the project document, progress reports, and outputs. This review will serve to (a) generate an overview of the project, its context, proceedings, outputs and outcome; (b) develop a list of evaluation indicators for the assessment of the project; and (c) to collect data regarding the evaluation issues and indicators. Further documentation (e.g. workshop reports, financial statements) may be needed to answer specific issues, in which case these documents will be requested from the project manager or consultant. When necessary, additional information on project activities may be requested from the project management and/or reference information may be collected from independent experts;
- Interviews with project officers and (representatives of) major stakeholders involved in the project. These interviews will serve to (a) complete the overview of the project, in its context, and the relevance and (future) impact of the projects outcomes according to the involved organizations and stakeholders; (b) complete the fact finding regarding the evaluation issues and indicators; and (c) assist in the assessment of the project by asking the involved organizations about their impression of the projects results on specific issues (indicators), where relevant. During these interviews, fact finding will be supported by questionnaires developed during the desk review phase (semi-structured interviews).

- The analysis of the collected information, and assessment of the projects relevance, performance, success and potential impact. Collected data will be analyzed and structured according to the evaluation indicators. Where target values for evaluation indicators exist (in the project proposal or elsewhere), the observed results of the project will be compared to these target values. Where these target values do not exist a status quo description will be given and an assessment of the projects results based on a review of the project documentation (and the implied assumptions in it), reference information from similar developments (of thermal standards) in other environments, stakeholders opinions and the evaluators judgment. Where requested, a rating will be given based on this information. Together with the overview and contextual information, this will form the basis for the draft and final evaluation report, which will also include conclusions, recommendations and lessons learned.

*Recommendations and lessons learned*

The recommendations will be based on the data collected and analyzed and will focus on the evaluation issues (see paragraph 1.2) and the evaluation indicators. The recommendations and lessons learned will include:

- Remarkable practices and lessons learned regarding the project and its development context;
- Remarkable practices and lessons learned regarding project formulation;
- Remarkable practices and lessons learned regarding project implementation and management;
- Recommendations regarding major problems, outstanding issues or possible improvements in the projects design, implementation, monitoring or management;
- Recommendations regarding the follow-up of the project to reinforce the full implementation of the projects results and/or directions for future work aiming at similar objectives.

## 3. Deliverables & Planning

The planning of this evaluation is constrained by the time necessary to collect all relevant information, to (logistically) prepare a mission to Beirut and meet the relevant parties, and to allow sufficient time for commenting by the involved parties. The indicated planning thus depends on the availability of the necessary documents, people and comments, and can only be guaranteed for (the planning of) own activities.

### *3,1 Deliverables of the evaluation*

The deliverables of the evaluation are:

- List of evaluation indicators
- Questionnaires to be used during interviews
- Interviews reports (summary versions)
- Draft final report
- Final report

The list of evaluation indicators will be drafted during the desk review of project documentation and will be sent to the UNDP program officers for review. Comments will be reflected in the final version of the evaluation indicators, to be finalized at the end of the desk review stage.

At the end of the desk review stage, questionnaires will be prepared to support fact finding during the interviews with involved parties in Beirut. The questionnaires will be made available to UNDP for review.

Interviews with the project management and major stakeholders (as listed in the ToR) will be conducted in Beirut. The interviews will be semi-structured, assisted by the questionnaires (implying that there is no strict format for the interviews, but that the questionnaires will be used to raise issues with the interviewees and to guide the direction of the meetings). It is expected that interviews will on average take approx. 2 hours, and that all interviews can be arranged within the same week, and that the UNDP country office can assist in arranging the interviews. Summary reports (approx. 1 page) will be made from each of the interviews, to be annexed to the evaluation report. The interviews will be followed by a debriefing meeting with UNDP (in the same week), to discuss the evaluation in general, and the initial conclusions from the evaluation.

The final report will be drafted within two weeks after completion of the interviews (and debriefing meeting), and will provide a complete overview of the evaluation as described in this outline. The report will be structured along the following lines:

- Executive summary
- Introduction
- The project and its development context
- Findings and Conclusions
  - Project formulation
  - Implementation
  - Results
- Recommendations
- Lessons learned
- Annexes

The draft final report will be sent to UNDP, to be circulated among involved parties, for comments and feedback. Issues raised by the involved parties will be reflected in the final report, unless there are discrepancies in the opinions and/or findings of the involved parties and the evaluator, in which case these will be explained in an annex to the report. The final report is due within two weeks after receiving the UNDP feedback on the draft final report.

*Planning of the evaluation*

The planning of the evaluation consists of three stages:

- Desk review stage (review of documentation, evaluation indicators, interview questionnaires);
- Interview stage (interviewing project management & stakeholders, interview summary reports, debriefing with UNDP);
- Analysis stage (assessment of the projects results, ratings, conclusions, recommendations and lessons learned, drafting and finalizing final report)

The evaluation work can start one week after agreement with UNDP; approx. four weeks will be required to arrange a mission to Beirut. Assuming quick feedback to reports, and the timely availability of documentation, the planning of the evaluation can be as follows:

| Weeks from start | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contract agreement with UNDP | | x | | | | | | | | | | | | | |
| Desk review | Draft evaluation indicators | | - - - - x | | | | | | | | | | | | |
| | Comments evaluation indicators | | | | - - x | | | | | | | | | | |
| | Final evaluation indicators | | | | | - - x | | | | | | | | | |
| | Interview questionnaires | | | | | - - x | | | | | | | | | |
| Mission | Interviews & debriefing | | | | | | x - - - - - - - - x | | | | | | | | |
| | Summary interview reports | | | | | | | | x - - - - x | | | | | | |
| Final report | Draft final report | | | | | | | | | - - - - - x | | | | | |
| | Comments & feedback | | | | | | | | | | | - - - - - x | | | |
| | Final report | | | | | | | | | | | | | - - - - - x | |

(N.B. the draft final report follows two weeks after completion of the mission, which can be sooner than week 9)

## *Annex 3 Evaluation indicators*

This evaluation aims at assessing the projects relevance, performance and success, early signs of impact and sustainability of results, identifying lessons learned, and making recommendations for the sustainability of project outputs and for future projects. For this, evaluation indicators will be developed, based on the evaluation issues stated in the Terms of Reference. The indicators are intended to measure the performance, management and impact of the project and will guide the evaluation process. Data will be collected to assess the performance of the project, via a review of project documentation and outputs, and interviews with key persons (during a mission to Lebanon).

### Indicators for the evaluation of project formulation[14]

- Conceptualization/Design (R)
  1. Project design targets root causes of building energy consumption
  2. Project design (summarised in LogFrame) is appropriate and suitable for the national context
  3. Project design includes sufficient indicators to track progress and measure outputs
- Country-ownership/Drive
  4. Project concept originates from within and is supported by national institutions
  5. Project concept targets pressing national environmental and development needs
- Stakeholder participation (R)
  6. Stakeholders have been actively and passively informed about the project and its results
  7. Key stakeholders have been consulted about core project decisions and have provided significant input into the project
- Replication approach
  8. Project has communicated lessons learned and sought cooperation with new or ongoing projects of similar concept
- UNDP comparative advantage
  9. Project is linked with other projects or programmes in the sector via well-developed management arrangements

### Indicators for the evaluation of project implementation

- Implementation Approach (R)
  10. Logical Framework is used as a management tool during implementation
  11. Implementation management is adaptive to changes in the project environment
  12. ICT have been used to support project implementation and dissemination

[14] These indicators are based on the Terms of Reference for Final Project Evaluation. Indicators have been selected to represent a large segment of the identified evaluation issues in a single, measurable item. Valuations of the evaluation issues (were applicable) will represent an average of the performance on the indicators for that issue.

13. The project established suitable operational relations between involved institutions and key stakeholders

14. The project employed the required technical capacities and made appropriate use of these

- Monitoring and evaluation (R)

15. The project has established progress monitoring and has undergone regular evaluations, which have led to required adaptations of the implementation

- Stakeholder participation (R)

16. The project properly involved national and local stakeholders in implementation and decision making

17. The project properly involved government and other relevant institutions in implementation and decision making

18. The project disseminated the required information to all relevant stakeholders

- Financial Planning

19. The actual spending on project activities was cost-effective and proportional to the projects objectives

20. Financial management was timely and adequate

- Sustainability

21. The project established a sustainable impact in the country, which will continue independently

22. The project established arrangements with relevant organisations or other instruments to secure a continued impact

- Execution and implementation modalities

23. UNDP provided adequate oversight of the project and assignment of the required experts

Indicators for the evaluation of project results:

*Project Development and Immediate Objectives (evaluating final outcome / impact of the project, related to Attainment of Outcomes/ Achievement of objectives (R) and Sustainability)*

- Reduce greenhouse gas emissions (Development objective 1)

24. Projected emission reductions based on realised project results (baseline: annual energy saving of 0.02 MTOE pa – LogFrame Objectively Verifiable Indicators)

- Establish thermal energy standards for buildings and prepare grounds for future adoption of the standard as an energy code for buildings (Development objective 2)

25. Thermal standard established and endorsed by the Lebanese Government and The Order of Engineers and Architects (LogFrame Objectively Verifiable Indicators / Means of Verification)

- Initiation of a transformation in the construction industry in Lebanon (Development objective 3)

26. Voluntary application of thermal standard (guideline) in new buildings designs and construction (LogFrame Means of Verification - adapted)

- Review of the 'Thermal Building Guidelines' prepared by LIBNOR and conduct an environmental, Economic and Social Assessment of these guidelines (Immediate objective 1)

27. Assessments show national and consumer benefits of thermal guidelines / thermal standard adoption (Success criterion 2)

28. Thermal guidelines / thermal standard are technically sound (Success criterion 3)

29. Market transformation programmes and financing schemes developed (Output 1.4 / 1.5)

- Production of completed and agreed-upon thermal building standard document (Immediate objective 2)

  30. Thermal standard accepted by relevant stakeholders: LIBNOR, LEBDUP, OENGAR, CDR (Success criterion 1)

  31. Thermal standard available for voluntary use in Arabic, English and French (Success criterion 2)

- Dissemination and sensitization of policy makers, professionals and the general public (Immediate objective 3)

  32. Policy makers and professionals knowledgeable of economic, environmental and social impact of thermal standard implementation (Success criterion 1)

  33. Increased general public and developers awareness of economic incentives for financing and adopting thermal building guidelines (Success criterion 3)

- Capacity building of resources and skilled manpower in thermal building standard adoption methods and designs and in certification and verification process for compliance (Immediate objective 4)

  34. Skilled human and resource capacity will have been built in the field of thermal standards in buildings in preparation for initiating a transformation of construction industry (Success criterion 2)

  35. An institutional mechanism is built for verification and certification of building standard compliance by developers on voluntary basis (Success criterion 3)

## *Annex 4 List of documents reviewed*

The list of documents reviewed has been expanded during the evaluation process, primarily to allow for a detailed analysis of the technical outputs.

Reviewed documents are:

- Project Document
- Annual Project Progress Reports
- Annual reports of tripartite meetings
- Initial and final budget statement
- Key Project Outputs:
  - Climatic Zoning for Buildings in Lebanon
  - Energy Analysis and Economic Feasibility Study
  - Thermal Standard for Buildings in Lebanon
  - Technical Guide for the application of the thermal standard for buildings in Lebanon
  - Software tool
  - Climate and comfort, passive design strategies for Lebanon (draft report)
- Guide to the Thermal Insulation and Summer Comfort of Buildings in Lebanon
- Various interim technical outputs first international consultant (draft reports)
- Technical background information to the Energy Analysis and Economic Feasability Study:
  - 050330 Office Result Extraction and Econ Analysis
  - 050331 Residential Result Extraction and Econ Analysis
  - 050411 Impact analysis

## *Annex 5 List of persons interviewed*

Interviewed stakeholders are:

(Tuesday 30 August)

- Joseph Abdel-Ahad, General Director of Urban Planning
- Jean Pierre Bassili, Project Focal Point at DG Urban Planning
- Edgard Chehab, UNDP Program Manager
- Nesreen Ghaddar, ME Chairperson & Fadl Moukalled, A. Dean FEA / American University Beirut

(Wednesday 31 August)

- Antoine Semaan, Lebanese Standards Institute (Libnor), Director
- Wafaa Charafeddine, Council for Development and Reconstruction, UN-CDR Coordinator
- Rola El-Cheikh, Ministry of the Environment, Member of Project Steering Committee
- Anwar Ali, Lebanese Centre for Energy Conservation Project (LCECP), Project Manager
- Nabil Abou Jawdeh, President of the Mechanical Consultants Branch, Order of Engineers and Architects (OEA)

## *Annex 6 Summary interview reports*

### Introduction

This report includes summary reports of the interviews conducted for the final project evaluation of the project 'Capacity Building For the Adoption and Application of Thermal Standards for Buildings', during a mission to Lebanon on 29th August – 2nd September 2005.

In addition to the interviews reported here, the project manager, Matilde El-Khoury, provided an extensive briefing of the development of the project. A debriefing meeting with the UNDP project officer, Edgard Chehab, concluded the mission to Lebanon. The information from these two meetings is included in the final evaluation report, and is not separately reported here.

### Joseph Abdel-Ahad, General Director of Urban Planning

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. National need for building standard – relationship with / root in national policies?
4. Issues covered by project sufficient to improve thermal comfort in buildings?
5. Government and OEA endorse voluntary and mandatory implementation of thermal standard?
6. Policy makers, professionals and the general public are properly aware of the need for and practicalities of thermal standard?
7. Market transformation programmes and/or financing schemes in place or prepared to support standard?
8. Suggestions for follow-up work to sustain project outcome?

Key issues

- The project is in line with national goals: reduce the national energy cost, and reduce carbon emissions;
- Thermal improvement of all new constructions will bring important benefits to the country;
- Heating and cooling of homes is often limited to a single room, as many people cannot afford to heat or cool their whole house. Energy cost has a very serious impact on the household budget;
- The national construction sector will need time to adapt to the new Thermal standards, thus a transition period (of voluntary implementation) is needed. During this period, (voluntary) compliance can be monitored via DGUP records;
- Verification & enforcement of thermal standard requirements is currently not possible, as there is no government infrastructure for this yet;
- It is currently investigated how the compliance checking infrastructure for the construction issues could be improved;
- The project has achieved good results, in a fairly short time;
- The commitment of the project manager and the engagement of the stakeholders are recognised as outstanding aspects of the project implementation;
- Activities to include the Order of Engineers and Architects in the projects, as well as outreach to building developers, have been important in the project;

- A non-financial incentive has been introduced in the new building law (exemption of a land-use rule for buildings with insulated walls, linked to the thermal standard). This is expected to provide a strong push for (voluntary) adoption of the Thermal standard;
- Mandatory implementation of the standard is planned for 2010;
- Three activities would be beneficial to sustain the project outcome:
    - Certification of engineers to perform thermal standard compliance checks;
    - Dissemination of the impact of thermal standard adoption (on energy cost) to building developers and owners;
    - Labelling / certification of (local) building materials, on energy aspects.

Jean Pierre Bassili, Project Focal Point at DGU

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. All relevant stakeholders were properly informed about the project?
4. Thermal standard is applied in new buildings – to what extent?
5. Activities and project planning have been adopted reflecting changes in project environment – based on (updated) LogFrame?
6. Project progress was frequently monitored, and implementation adapted via a formalised procedure?
7. Project has interacted with other, similar projects to exchange experiences and lessons learned?
8. Project spending was proportional, without material issues in budgeting and/or disbursement?
9. Project team development was adequately initiated and supervised by UNDP?

Key issues

- The first step in the improvement of the thermal performance of buildings has been achieved, which is very important;
- The project team ended up spending most of its time on guiding technical work, which was justified given the technical difficulties encountered;
- The selection of the initial international consultant was compromised: too much attention was given to the lowest price, at the expense of quality. This has later led to serious difficulties in the project;
- Stakeholder involvement was very good, with the Order of Engineers and Architects as the most important stakeholder;
- The involvement of Libnor was limited initially. This improved during the project, and they are now taking the Thermal standard forward;
- The Thermal standard is now adopted as a voluntary standard. The planned adoption as a mandatory standard may be at risk if the political situation in Lebanon doesn't improve;
- The project oversight, with regular updates and close cooperation with the UNDP Country office, was very satisfactory. A more formalised procedure (e.g., via project document updates) was not needed.

- Regional cooperation was beneficial to the project. Especially contacts with Jordan, which had been going through a similar legislative process before, were appreciated;
- The project team was successful, and was set-up in good cooperation with the UNDP country office;
- Three activities would be beneficial to sustain the project outcome:
    - Responsibility for the (mandatory) implementation of the standard should be clarified;
    - The building permit procedure, including compliance checking of the thermal standard, would need improvement;
    - The Lebanese Centre for Energy Conservation Project (LCECP) should take up the results of this project and promote adoption in the construction market.

Edgard Chehab, UNDP Programme Manager

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. Activities and project planning have been adopted reflecting changes in project environment – based on (updated) LogFrame?
4. Project progress was frequently monitored, and implementation adapted via a formalised procedure?
5. Project has interacted with other, similar projects to exchange experiences and lessons learned?
6. Project spending was proportional, without material issues in budgeting and/or disbursement?
7. Project team development was adequately initiated and supervised by UNDP?

Key Issues

- This project was a success, and the key success factor was the excellent project manager;
- The project was designed to go hand-in-hand with the LCECP (Lebanese Centre for Energy Conservation Project) project; this work out only partly, due to significant delays (and a subsequent re-start) of that project;
- Stakeholder involvement (the Order of Engineers and Architects and many others) was very good, and very beneficial to the project;
- The Thermal standard has been fully prepared for (mandatory) adoption, but the Ministry of Public Works decided not to engage in mandatory adoption now, which is unfortunate;
- The momentum for improvement of the thermal performance of buildings has been created, and this will continue on its own. More attention, however, would strengthen this process;
- The creation of an Energy Efficiency chapter at the Order of Engineers and Architects, and the technical capacities / technical backstopping provided by national universities stand out as valuable elements in the project;
- The preparation of the market to the thermal standard implementation did get little attention in the project. This could include the communication / certification of building product requirements;

- Project progress was adequately monitored via extensive yearly progress reports. Other formal procedures were not needed, as there were frequent contacts with the project manager and issues were highlighted in the progress & tri-partite reports;
- The yearly progress reports (which are an addition to the formal UNDP/GEF procedures) served to track progress, and propose adaptation of activities and budgets where necessary;
- The capacity building target was not quantified in the project document; this created some uncertainty regarding the required efforts in this area;
- The UNDP country office provided intensive, hands-on supervision, and has kept good track of upcoming issues and needs to adjust timing, activities or budgets. Based on the results achieved, this seems to have been successful;
- This project has benefited from contacts and exchange of lessons learned with similar projects in the region, as have the other projects;
- Spending on the project was optimised, and the activity budget adjusted reflecting developments in the project. Spending was adequate and justified;
- Project disbursement was delayed, reflecting delays in the project, and the termination of the international consultancy contract and subsequent contracting of a new consultant;
- Project team development followed standard UNDP procedures, in cooperation with the executing agency (DG Urban Planning);
- The project manager has provided quality control on all outputs, in collaboration with national institutions (universities, Order of Engineers and Architects);
- The selection of the international consultant was not very successful. The Terms of Reference were not specific enough, and too much focus was given to the lowest price only. In response, UNDP has improved its tendering rules, with stricter technical requirements and an integrated assessment of cost versus quality of the proposals (instead of the previous sequential assessment).

Nesreen Ghaddar, ME Chairperson & Fadl Moukalled, A. Dean FEA / American University Beirut

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. Suggestions for follow-up work to sustain project outcome?
4. Development of technical outputs (climate zoning; energy & economic analysis; thermal standard; technical guide) – applicability, data availability, technical inputs, modelling, adoption process, updating requirements?
5. Capacity building / training of professionals in thermal standard & technical guide?
6. Issues covered by project sufficient to improve thermal comfort in buildings?
7. Policy makers, professionals and the general public are properly aware of the need for and practicalities of thermal standard?

Key issues

- The Thermal standard is needed for Lebanon, even if not all technical details are perfect. The results achieved form an excellent first step;
- There is a need to include locally manufactured building materials in the thermal standard tools. Technical characteristics are yet unknown, making it difficult to include these materials in a certification process;

- The Thermal standard, and the underlying work, relate to what is taught in university training. This makes it possible to integrate training in thermal standard issues with regular training of engineering and architecture students,, which is an important asset of the work done;
- The technical knowledge of the project management was an important asset to the project, and has significantly contributed to the quality of the outputs;
- The selection of consultants was based on lowest price offered, in the first phases of the project. This neglected the balance between price and quality, which has had a negative impact on the project;
- The planning of activities in the project changed relatively often. A better planning might have prevented this;
- Stakeholders and nationally involved parties claim that the developed Thermal standard is manageable and that prescribed performance levels can be achieved in practice with currently available skills and construction methods;
- The American University of Beirut has been involved in stakeholder workshops / training sessions, and has presented a software model to assist compliance checking. They observed that:
    - Mechanical engineers in Lebanon are well aware of thermal performance issues, and should be able to implement the Thermal standard without difficulties;
    - Architects have a more limited understanding of thermal performance issues, as many have not been exposed to this during their formal training, and may need additional training to fully understand the underlying concept and be able to implement the Thermal standard;
- The application of the thermal standard is encouraging, as a thermal performance matching the requirements of the standard is already occurring in a significant number of new building designs, particularly in the mountain zones. Actual statistics, however, are not yet available.
- Four activities would be beneficial to sustain the project outcome:
    - To further the goal of the project, and improve the thermal standard (consideration of condensation issues & thermal bridges; recalculate economic analysis with new energy prices);
    - To describe the thermal properties of locally manufactured building materials;
    - To educate local industry and the public, and create incentives for the local industry to develop quality products;
    - To develop a verification capacity, and enforce the thermal standard.

### Antoine Semaan, Lebanese Standards Institute (Libnor), Director

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. Development of technical outputs (climate zoning; energy & economic analysis; thermal standard; technical guide) – applicability, data availability, technical inputs, modelling, adoption process, updating requirements?
4. Verification, certification and enforcement mechanism in place for voluntary and developed for mandatory implementation?

5. Key stakeholders (LIBNOR, LEBDUP, OEA, CDR) accept and endorse thermal standard?
6. All relevant stakeholders were properly informed about the project?
7. Suggestions for follow-up work to sustain project outcome?

Key issues

- Libnor unfortunately didn't have the staff to be sufficiently involved in the project from the beginning, but this development has developed;
- Libnor is now processing the Thermal standard through its procedures, to have it adopted as a (formal) national standard;
- The commitment of a good, organised project team, and the involvement of all national stakeholders, governmental, private sector and institutional, made the project work;
- The project had many delays, more decision power for the project manager might have been better to respond to emerging issues;
- The project document didn't include an assessment of test standards for thermal performance. This would be needed for a further evolution of the Thermal standard;
- Data availability (particularly climate data) was a limiting factor in the technical analysis. The simulations, developed as an alternative, were a good replacement. However, it is important to note that the technical analyses have been performed with these simulations and are not based on actual measurements;
- In Lebanon, the components for a verification system were not in place, thus severely limiting the options for verification & enforcement of the Thermal standard. There are for example no quality management systems in place, or internationally accredited laboratories for testing building laboratories. The Industrial Research Institute has a large test capacity, but this doesn't include thermal performance. The American University of Beirut has developed a test capacity, but this is mainly for research and education purposes, not for industrial use;
- Libnor is expanding its technical capacities, to create more certification capacity. It is discussing a Memorandum of Understanding with the Cyprus standards institute to gain access to the European Accreditation scheme;
- All stakeholder groups have been part of the Thermal standard development process, but not all individual stakeholders. There are some 30,000 engineers in Lebanon, many of these involved in building design. Although many have been reached during the project, many others have not participated and will need to be reached in some form later on;
- Coordination between projects could be improved, to create a more integrated approach for energy efficiency or construction quality;
- Four activities would be beneficial to sustain the project outcome:
    - Development of an enforcement system, integrated in the building permit process;
    - Pilot projects or demonstration buildings
    - Urban planning recommendations (orientation, etc)
    - Fiscal incentives for implementation of Thermal standard;
    - Adoption of EU test standards for construction materials.

Wafaa Charafeddine, Council for Development and Reconstruction, UN-CDR Coordinator

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. National need for building standard – relationship with / root in national policies?
4. Relevant institutions and stakeholders adequately involved in project decisions and implementation?
5. Market transformation programmes and/or financing schemes in place or prepared to support standard?
6. Policy makers, professionals and the general public are properly aware of the need for and practicalities of thermal standard?
7. Suggestions for follow-up work to sustain project outcome?

Key issues

- Thermal performance, or energy consumption, was a new issue to the government, before this project started.
- The project was important for the government, represented by the DG Urban Planning. The project results are good, and have also fed into the land-use master plan of the CDR (specifically: Climate zoning);
- Traditionally, climate considerations (thermal comfort, quality of life) were more important in building design, but this attention faded during and after the war;
- The inclusion of the important stakeholders (like the Order of Engineers and Architects) in the project was commendable, and there is much appreciation of the project manager's work;
- The involvement of Libnor, a key stakeholder, in the development of the standard was (too) limited in the early stage of the project.
- Most important is that engineers get to understand the importance of the thermal performance of buildings, and of the economic benefits of thermal insulation;
- There is now a basic understanding of energy efficiency with the public and politicians, but the trade-off between (usually higher) first cost and (lower) running cost is not well understood, nor acted on;
- The mandatory adoption of the Thermal standard needs to be pushed ahead, by the national organisations that have taken leadership on this (DG Urban Planning, Libnor), probably in coordination with the Ministry of Energy, the Ministry of the Environment and the private sector. The time until the planned mandatory implementation, five years, may appear long, but legislative procedures also take time, and can easily stall;
- Four activities would be beneficial to sustain the project outcome:
    - An awareness raising campaign;
    - A well-planned push for mandatory adoption of the Thermal standard;
    - A coordinated effort with industry to improve local manufacturing and make quality building materials available;
    - The introduction of thermal standard requirements in building permits by municipalities. DG Urban Planning could introduce this.

### Rola El-Cheikh, Member of Project Steering Committee

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. National need for building standard – relationship with / root in national policies?
4. Relevant institutions and stakeholders adequately involved in project decisions and implementation?
5. Market transformation programmes and/or financing schemes in place or prepared to support standard?
6. Policy makers, professionals and the general public are properly aware of the need for and practicalities of thermal standard?
7. Suggestions for follow-up work to sustain project outcome?

Key issues

- The project was very successful. During project implementation, stakeholders realised that they would require more (and sometimes different) outcomes than originally planned, and set out to achieve these (which they did);
- The project was placed at the DG Urban Planning. That made it more acceptable to the construction sector;
- Despite the fact that coordination with the 'Lebanese Centre for Energy Conservation Project' was unsuccessful (NB this project was significantly delayed), the Thermal standards project was successfully marketed, on its own;
- The new Thermal standard will be part of the national environmental action plan, which should be beneficial for the implementation / adoption of the standard;
- The project completed its technical work, despite some serious difficulties. This is commendable;
- Outreach activities were tailored to the needs of the private sector. This significantly helped in being successful in that sector. However, it also made public sector involvement more difficult, and it could be considered to organise specific public sector events in similar projects in the future;
- The non-financial incentive for thermal standard implementation, included in the new building law, is a true breakthrough and constitutes significant support for the Thermal standard;
- The banking sector is interested in supporting energy efficiency, because it protects the investment. Banks, however, want to focus on the whole building, not on insulation / the building envelope separately;
- There is public understanding of the need to conserve energy, because of the high cost of energy. Policy interest is focused on saving money, on the national budget and for consumers;
- Two activities would be beneficial to sustain the project outcome:
    - Attention for appliances and equipment, to complement the thermal standard (for the building envelope), particularly air conditioners and water heating;
    - Television messages to promote energy conservation.

Anwar Ali, Lebanese Centre for Energy Conservation Project (LCECP), Project Manager

Questions

1. Overall impression of the project?
2. Observed best and worst practices in project implementation?
3. Suggestions for follow-up work to sustain project outcome?
4. Market transformation programmes and/or financing schemes in place or prepared to support standard?
5. Policy makers, professionals and the general public are properly aware of the need for and practicalities of thermal standard?
6. All relevant stakeholders were properly informed about the project?
7. Thermal standard is applied in new buildings – to what extent?

Key issues

- LCECP was re-started in January 2005; this implies that the (intended) coordination of activities between LCECP and the Thermal standards project was very limited. It also implies that there is limited knowledge of the pre-2005 proceedings of the Thermal standards project;
- During the re-start of LCECP, the project document was reviewed, and the project will support the outputs of the Thermal Standards project, within the LCECP project framework, especially for marketing activities and partially for financial activities;
- The close follow-up and quality control of activities and contractors work at the Thermals standards project is commendable. The involvement of stakeholders, early on in the development of outputs, as well as in the review of results, is an example of good implementation practice;
- The selection of consultants (which basically comes down to a price-only comparison), has had severe negative impacts. There may be analogy with energy efficiency: the lowest first cost is not always the best solution;
- LCECP will include in its socio-economic survey of public knowledge and attitude of thermal performance issues, and initiate awareness raising activities with the general public;
- LCECP will conduct a market survey for the EEB project, but technical input needs to be provided by EEB project. With respect to the financial sector, LCECP will study, within its project framework, the financial sector feedback on the outputs of the Thermal Standard project;
- Stakeholder institutions are well-organised and have been well involved in and informed about the Thermal standard, but not all individual members (approx 30,000 engineers & architects) could be reached;
- LCECP and the Thermal standards project have jointly participated in the Energy Week at the Order of Engineers and Architects;
- The Lebanese market is a complex one, with low understanding of the first cost / running cost trade-off, low purchasing power and a relatively high share of non-metered, non-billed energy energy;
- It is too soon to tell what the impact of voluntary adoption of the Thermal standard will be (in the construction market): the new building law was adopted only 4 months ago, and the first stage of the building permit process alone takes 2 to 3 months.

- Next to the activities of LCECP, it would be beneficial to sustain the project outcome to initiate demonstration projects showing the effects of better thermal performance in buildings.

**Nabil Abou Jawdeh, President of the Mechanical Consultants Branch, Order of Engineers and Architects (OEA)**

Questions

1. Overall impression of the project?
2. Issues covered by project sufficient to improve thermal comfort in buildings?
3. Development of technical outputs (climate zoning; energy & economic analysis; thermal standard; technical guide) – applicability, data availability, technical inputs, modelling, adoption process, updating requirements?
4. Capacity building / training of professionals in thermal standard & technical guide?
5. Government and OEA endorse voluntary and mandatory implementation of thermal standard?
6. Verification, certification and enforcement mechanism in place for voluntary and developed for mandatory implementation?
7. Thermal standard is applied in new buildings – to what extent?
8. Suggestions for follow-up work to sustain project outcome?

Key issues

- The project concept was timely and necessary: a thermal standard, enforced by law, was needed to improve the thermal performance of buildings. Due to the bad economic situation, higher first cost (of better buildings) is a major barrier. Without a law, nothing would have happened;
- There is general acceptance of the Thermal standard by professionals; there are no major comments to it. There is an issue with the climatic zoning, which may need to be adapted to accommodate many micro-climates;
- Application of a thermal standard is more difficult than the technical development work. The verification procedure, which still needs development, is a major concern to professionals;
- The cooperation with the UNDP country office was excellent;
- The Thermal standard should, in a 2nd stage revision, be extended to include air infiltration, ventilation and thermal bridges. It may be possible to include these elements in a (supporting) software tool sooner. Equally, HVAC equipment should be integrated in a future revision of the standard. Stakeholders questioned these issues and when these would be included in a revision;
- In the development of the thermal standard, attention was given to the fact that cavity walls are the preferred construction option already, and cavity wall insulation should be preferred over other methods. This is due to the fact that the construction of insulated cavity walls is puts smaller demands on the availability of skilled labour;
- Many practising engineers and architects (a bit more engineers than architects) participated in the project via workshops, where they discussed the development of the Thermal standard. All project outputs will be made available via the OEA website (the website is ready to go online, and is awaiting the finalised project outputs);

- Architects will have to deal with thermal issues, and need to apply the Thermal standard requirements. A full understanding of thermal performance issues, however, is not required;
- The OEA is committed to support the project outputs by:
    - Making all results available via a dedicated section at their website;
    - The energy saving committee at the OEA, cross-cutting all sections, to sustain the issue of energy efficiency;
    - The organisation of an Energy week, every year;
    - The evaluation of the implementation of the Thermal standard, once a year;
- Verification & enforcement procedures should be developed similar to those currently being developed for other building quality aspects. Thermal standard compliance should be added to a list of construction details for compliance checking in a wider scope procedure;
- Verification & enforcement should take place during two stages: building design, and construction. The first requires a check of drawings and construction specifications, the second one or more inspections on-site;
- Verification & enforcement could take place at existing (commercial) verification offices (mainly branches of European organisations), provides these create a separate unit for building quality verification;
- At the high-end of the market, the Thermal standard is already applied for building design;
- It is estimated that, out of approx. 3000 new construction projects per year, approx. 200 already comply with (or are above) the requirements of the Thermal standard. This estimate is based on the checks that the OEA performs on building permit applications;
- Four activities would be beneficial to sustain the project outcome:
    - Monitoring how many buildings (voluntarily) apply the thermal standard at the design stage (based on building permit applications);
    - Generating more publicity in specialized magazines (for engineers and architects);
    - Testing the Thermal standard, and the validity of the climatic zoning, during the voluntary stage, and monitoring the effects in practice of applying the standard;
    - Adding an item about the (voluntary) application of the Thermal standard at the formal building permit application form, to promote consideration by all architects / engineers during the design phase.

## *Annex 7 Detailed technical comments regarding project outputs*

These comments target the main technical outputs of the project, and are in part based on an analysis of underlying work and on additional information supplied by the project management. As recommended, these comments have been discussed with the experts involved in the last part of the preparation of the technical outputs, to check the underlying models and assumptions and to analyze if corrections are needed to the outputs. It should be noted that work on the main technical outputs was initiated by one consultant, and finalized by another, due to some serious issues with the outputs delivered by the first consultant (see also the notes under item 6 of this annex). The subsequent work to upgrade of these outputs, by the second consultant, had a limited scope and could not include a full revision of all work. This has had some serious consequences for the quality of the final outputs, as listed below.

### 1. Climate Zoning for Buildings in Lebanon

- The report describes some climatic parameters for climatic zoning, but fails to identify principles of climatic zoning or a clear method for selecting and defining zones. No reference is made to available literature and to common climate zoning methodologies. The approach selected is purely numerical, but of a very limited scope. Given the budget limitation, the limited scope is justified, but a better consideration of climate zoning methodologies and would have been preferable;
- Reference is made to some aspects of regulating building energy demand (specifically: air infiltration). Contrary to what is stated, regulating air infiltration is an important aspect is many advances building energy standards (although not necessarily included in a first step);
- The Climatic Zoning report presents a formula (equation 3) for the calculation of climatic zones. This formula is based on a rather unusual addition of heating and cooling degree days, including a correction factor for the cooling degree days. There is no rationale for this addition, and it is not in line with international practice. Following a discussion of this issue, this formula is being removed from the report;
- Further, no reference is given for the selection of 18°C and 21°C thresholds for the calculation of degree days. This, however, should be considered a minor point, as literature shows that this threshold has a limited impact on the resulting zoning;
- Additional information learned that the formula has later been discarded, and the final climatic zoning is based on a separate analysis of heating and cooling degree days. This appears to be a good approach, based on the limited availability of data. Following a discussion of this issue, the PMU has decided to change the final report, by updating the relevant sections (section 2.3 and chapter 3) and replacing the combined index with separate indices for heating and cooling degree days in the tables and graphs in the report;
- The final selection of the climate zoning is reported as being based on altitudes, rather than directly on the calculated heating (and cooling) degree days. A discussion with the consultant involved learned that the approach followed is more elaborate, taking into consideration degree days and altitude. This approach should be better reflected in the report;
- In general, four zones appears to be a large number for a relatively small country. It could be considered if less zones (e.g. one single mountain zone) would also be sufficient. For comparison: the United States have recently updated the climatic zoning for the country, after an extensive analysis of all aspects of climatic zoning (http://www.energycodes.gov/implement/pdfs/climate_paper_review_draft_rev.pdf). This resulted in only eight climate zones for the whole country; for example: all Rocky Mountain States are included in a single zone.

## 2. Energy Analysis and Economic Feasibility Study

- The report of this analysis included several errors and omissions. Many aspects of the energy analysis have been changed during the preparation of this work, but were not reflected in the report. Following a discussion of these issues, the analysis and the report have been upgraded. In its final form, the report will be an adequate output of an analysis with a limited scope.;
- The Visual DOE-3 software was selected for the modeling of building energy consumption. This is a rather detailed analysis tool, but requiring a lot of detailed input data. The report would benefit from background information about the reasons for selecting this model, and a note about the data requirements for this tool;
- The selection of building types, for energy calculations, is rather limited. One residential (5-floor) building was selected, representing a small segment of the total building population. Additionally, one commercial building was modeled. This misrepresents that building typology (e.g., envelope to floor size) usually has a high impact on the relative impact of thermal insulation. An attempt should have been made to model more building types (number of floors, shapes, orientations), even if this implied that the actual analysis would have been more limited. This omission implies that the results of the current analysis cannot be generalized to the average Lebanese building;
- The energy price range used in the analysis probably reflects the prices at the start of the analysis, which is a correct approach. Energy prices have risen substantially in the last year, and this can have a large impact on the outcomes. It is recommended to add this information to the report, indicating the likely impact of higher energy prices on the cost-effectiveness of the suggested thermal insulation measures;
- The insulation values reported in the report (chapter 2), and used in the energy calculations, are not consistent with the technical detailing. Specifically, it appears that incorrect thermal insulation values have been used for polystyrene (R=0.35 per cm, instead of the correct 0.25). Since this material is the reference insulation material in the calculations, this error is likely to have affected all energy / economic calculations. Following a discussion of this issue, the calculations and the report have been updated;
- “The detailed energy data show an unusual impact of wall insulation on cooling energy demand. A discussion of this issue learned that this can be explained by the fact that in the modelling, interior temperatures at night are not controlled, and buildings can heat up to temperatures above the outside temperature. This choice was made to reflect the current user behaviour in Lebanon, but it should be noted that this is a deviation from the design conditions of a cooling system. The approach selected should be explicitly described in the report, and, as the impact of this choice is rather significant, preferably accompanied by a brief, qualitative explanation of the impact of this choice on building energy demand;
- The report provides a rather scarce description of the modelling approach and the input parameters used. This makes it very difficult for stakeholders to review the modelling and the energy & economic analysis. A full description should be added to the report.;
- The base case modeling description of buildings (annex 1, annex 2) does not properly reflect the actual thermal conductivity values for building materials. It is understood that these have been corrected later on, but this is not reflected in the report;
- The base case and alternative models for wall insulation are not properly designed and reported. The base case is a single wall; the alternative case a cavity wall. The rationale for this is that cavity wall insulation fits (a lot) better with construction practices in Lebanon, but this is not included in the report. Additionally, an attempt should have been made to separate the impacts of the cavity wall and the added insulation, to assess the

impacts of these separately. Since cavity walls are the preferred option for some other reasons, it should have been assessed what the impact of insulation is if a cavity wall is already planned;

- The energy analysis has modeled a packaged air conditioning system with an efficiency of 0.32 kW input / 1 kW output. This reflects an Energy Efficiency Ratio of 3.125. It should be noticed that this ratio is far better than the average marketed air conditioner, and is too high. This results in an underreporting of cooling energy demand, and cooling energy reductions due to modeled measures, of around 20%. For reference: the current most stringent air conditioner standard in the world (Taiwan) prescribes and EER of 2.6 to 2.7, and an ratio of 3.0 represents already the top class on the EU energy label. It should be noted that packaged air conditioner systems are in general the least efficient types, and it would have been logical to model a split system, certainly for office buildings;
- The incremental cost calculation for wall alternatives does not correspond to the reported technical and price characteristics. If the reported characteristics are correct, the reported incremental cost is at least $\$4/m^2$ lower than reported, thus overestimating the incremental cost by 25% to 34% (with a similar impact on net present values). Following a discussion of this issue, the calculations and the report have been updated;
- Recommended thermal transmittance values for building components in the report differ from those identified in the energy and net present value calculations. It appears that an interim step has been performed, with two 'model buildings', but largely ignoring the results of the energy and net present value calculations;
- The impact analysis (filename 050411 Impact Analysis) follows an unusual, and unjustified, itinerary: first, the heating and cooling energy demand reductions are added together per building type and zone. No conversion of fuel and electricity price, primary energy impact or carbon impact is being made. With the thus obtained average energy savings, a country-wide weighted average is calculated, for residential and office buildings. The weight factors (based on the number of buildings per zone) are questioned, as these appear unrealistic. Instead of a proper revision, an 'acceptable' savings percentage (of 30%) is selected. This is used to calculate the national energy impacts, which are then considered to be electricity only, and converted to fuel cost (using international barrel prices). The resulting values are reported as national impacts. This is a very questionable approach. Following this evaluation, most of these errors were corrected (but, unfortunately, not the summarizing of fuel and electricity impacts);
- Given that most of the issues related to the analysis are being corrected, and that the report is being upgraded to reflect this, the energy analysis and economic feasibility study should be considered a sound technical output. The scope of the analysis, however, was limited, due to budget and other limitations, and it is recommended to extend this analysis to cover important aspects that have not been included now.

### 3. Thermal Standard for buildings in Lebanon

- The Thermal standard lists a number of references, including building standards in other countries and reports about these, but excluding the Climatic Zoning and Energy Analysis reports that have been prepared. The main text, however, does not refer to any of the references;
- No rationale is given for the selection of (three) compliance paths. The need for a simple and a complex procedure is clear, but it would be recommendable to analyze the need for an intermediate version (to integrate all building components into one U value, but not integrate the fenestration ratio).
- Maximum U-values are specified for floors (exposed, semi-exposed) and skylights. Both have not been included in the Energy Analysis, and no indication is given to the rationale for (1) including these values in the Thermal standard and (2) the selected values;

- Maximum U-values specified for some zones (particularly zone 4, High Mountain) are very stringent, especially for roofs and walls in residential buildings. The indicated values (of 0.31 and 0.32, excluding air films) are significantly more stringent than is current practice in Europe (excluding Scandinavia), and would correspond to an insulation thickness of approx. 12 cm (instead of the reported 8 cm). At these insulation values, the effects of thermal bridges and air infiltration is very significant, both of which are not regulated with this Thermal standard. This has two likely impacts: condensation, at thermal bridges, possibly leading to a deterioration of the building quality and mould formation; and a severe reduction of the thermal performance of the building component. In general, these insulation values add little to the overall thermal performance of the building, unless all thermal performance aspects are included in the building design (and thermal standard). This is common practice in for example the United Kingdom and the Netherlands, but required U-values in these countries are 'only' at 0.35 and 0.40 (excluding air films) respectively. Following a discussion of this issue, these values are being adapted in this first step of thermal performance regulation. It is recommended to revise the issue in a next step, when issues like thermal bridges and air infiltration can be assessed;

4. Technical Guide for the application of the Thermal Standard for Buildings in Lebanon

- The Technical Guide specifies many issues (e.g., detailing of insulated walls) which are not listed in the Thermal standard. The status of these issues should be clarified since the Thermal standard refers to the Technical Guide;
- The Technical Guide (section 6) describes some examples of compliance. The listed thermal transmittance values for similar construction and insulation materials vary between tables, and unrealistic thermal transmittance values of basic polystyrene and polyurethane are applied for the calculation of insulation, resulting in misleading examples;
- Although the preferred construction method for Lebanon is a cavity wall, most examples refer to (internally or externally insulated) single walls. The preferred construction method should be demonstrated at least as much as the non-preferred ones, to adequately draw attention to this method;

5. Software tool

- The software tool appears to include all aspects of the thermal standard. An in-depth examination of the tools would be out of the scope of this evaluation;
- It is noted that the software tools also applies unusually high thermal resistance values for common insulation materials. These values do not comply with international practice, and it is strongly recommended to review these, as incorrect thermal resistance values for these materials will have a very high impact on the validity of the Thermal standard.

6. Brief review of technical outputs of the first international consultant

Following up on the unusual fact that the work of the first international consultant was terminated, and a second international consultant has taken over the completion of the required deliverables, a brief review of the outputs of the first international consultant was conducted. Additionally, several observations made by the second international consultant are listed here. The purpose of this section is to describe the issues that have led to the termination of the first consultant's contract.

Climate Zoning report (version Jan 27, 2003):

- In the first section of the report, some climate zoning methods have been described. There is, however, no reference to standard literature on climate zoning. No selection criteria have been given (implicitly or explicitly) for the choice of a specific method for Lebanon. However, in the conclusion of this section, it appears that a numerical method is chosen. This method implies that extensive amounts of data are required.

- The second section provides a limited description of available climate data, and various graphs showing world climate data. The relationship of the latter to the climatic zoning for Lebanon is not clear. No analysis is presented of the required versus available data, and the conclusions of this section are very general and not specific for Lebanon.
- The third section describes the definition of climatic zones for Lebanon. In this section, it is concluded that latitude, distance from the coast, topography and elevation are the relevant characteristics, with reference to section 1. Section 1, however, does not conclude this; rather, it prescribes a numerical approach in which large amounts of data are combined into one analysis. This section continues with describing that a number of climate factors will be analyzed, but then selects climate zones based only on latitude, ignoring all previously stated factors. No rationale for this selection is given. The section concludes with an overview of the importance of some climate factors for building design, but fails to link these to the climate zoning or other aspects relevant to the task.
- The second consultant noticed several discrepancies between the data reported in the report and the delivered background information, and what was mentioned in the sources for these data. Additionally, several omissions (of available data) were discovered, as well as some unmotivated deletions of available data;
- The hourly climate data, prepared for use in building energy demand simulations, included several systemic errors, as well as various errors, omissions, and misrepresentations. None of these were reported to the project management by the first consultant;
- Overall, this report (including the background material) does not constitute a sound basis for the development of climatic zoning, and is of doubtful quality overall. The project management was correct in not accepting this report as a final output.

Thermal standard report (version 1, March 18, 2003, and Final draft, Feb 2004)

- The first draft already includes a detailed structure for the eventual Thermal standard, but no rationale for the proposed approach, or for the selection of included elements (to be subject to Thermal performance regulations).
- The report presents an outline of the final deliverable (Thermal standard), without describing the methodology for developing this output, considerations regarding the approach and the included elements, building practices in Lebanon, the need to define reference buildings and situations, etcetera. Several references are listed (of building code developments in other countries), however, no reference is included in the main text and the source of the proposed solutions is not clarified. Overall, it is impossible to verify the rationale for any of these elements, due to the very limited explanations in the document;
- The final draft defines three building types to which the standard applies: new buildings, residential, offices and schools for which the design includes air conditioning; similar buildings, designed without air conditioning, and other commercial buildings. The differentiation between the first two categories is understandable from an energy point of view, but fails to account for the fact that retrofitting a building with air conditioning is a fairly easy measure, and it is very difficult to check in advance if a building will be equipped with air conditioning later on. The differentiation between homes, offices and schools on the one hand side, and other commercial buildings on the other, is difficult to understand. The first group includes almost all new buildings in Lebanon, and it is difficult to come up with a correct, single standard that applies equally well to all categories. The second group is so small that separation appears to be useless;
- Passive solar design buildings are (proposed to be) exempted from the standard. There is no rationale for this: passive solar design is not a defined type of building design, and

there is guarantee that the application of passive solar design guidelines will lead to a good thermal performance. Buildings with a good passive solar design, however, will almost always also have a good thermal performance, and exempting those from the standard (especially when this includes a performance path) is unnecessary;

- The report doesn't include a description of the development of the target values (maximum thermal conductivity values) for the building components in the Thermal standard. Project management reported that a synthesis of the energy simulation and economic analysis had been presented, but that this was unconvincing and was later found to include many errors. Such synthesis, however, should accompany the presentation of the findings, and this omission is considered to be a critical issue as such, independent of the quality of the underlying work;
- Project management reported that the consultant, when asked about the validity of his findings, confirmed that the modeling and calculation work were review and approved;
- At a later stage, the second consultant (who was given access to the underlying data for the development of target values) discovered various serious issues in the modeling of buildings for the calculation of energy demands. These include: an incorrect heating / cooling control system (not taking account of the zones in a building), leading to a severe misrepresentation of heating and cooling loads; the incorrect modeling of the building envelope (without thermal mass), which leads to a significant error in the reported heating and cooling energy demand; different building typologies in the different climate zones, making a national analysis impossible; an erroneous correlation of modeling output and the economic analysis (the model output should be transferred 1-on-1 to input for the economic analysis), which makes this analysis useless;
- Overall, the report was an insufficient basis for the further proceeding of the Thermal standard, since it did not provide any information about the background of the selected approach and target values. The errors in the modeling and calculations, later discovered, are serious and would have led to useless outputs.

Overall:

- The deliverables prepared by the first consultant, with the omission of rationales for approach, target values, and selected climate zones, were insufficient for the further development of the Thermal standard. The reporting, the refusal to allow scrutiny of the modeling and calculations, and the later discovery of many systemic errors, are not of a professional level;
- It is remarkable to see that some of the unfounded systemic choices of the first consultant (like the choice to model a very limited number of buildings, and the selection of three compliance paths) have been taken up without consideration by the second consultant. Some valuable elements, like attention for joints (thermal bridges), ventilation, vapor barriers and the (light) outside coloring of walls and roofs have not been included in further work, although these might have been valuable additions;
- In retrospect, the impression is that the work of the first consultant was not of a sufficient level for the task at hand. The second consultant has improved this work, but the results available during this evaluation were also not of a good, professional level. Following the evaluation, the second consultant has made several corrections to his work, which resulted in sufficient outputs, although of a limited scope. The reporting and approach of the work by the first consultant was also very unsatisfactory, based on project management information; the second consultant performed much better on these aspects. The difficulties with the work of both consultants probably indicate that the task was too complex to be handled in this way, with this budget, and by the consultants that presented themselves for this work. It is recommended that this issue is given proper consideration, to prevent similar experiences in similar projects elsewhere.